Railroads Play a Vital Role in This War Effort—They Must

Keep 'em Rolling

Reliance HY-CROME *Spring Washers*

MICROSCOPIC INSPECTION OF STEEL

This Metallurgical Engineer works for YOU— but is on our payroll

HY-PRESSURE HY-CROME
"Edgemark of Quality"

- Scientific QUALITY control must start with the raw material and continue through each step of production.
- A QUALITY product cannot be made from poor raw material, and good raw material can be ruined through faulty production methods.
- The superior QUALITY of Reliance Hy-Crome Spring Lock Washers is therefore scientifically guaranteed.

EATON MANUFACTURING COMPANY

RELIANCE SPRING WASHER DIVISION

MASSILLON, OHIO

Sales Offices: New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco, Montreal

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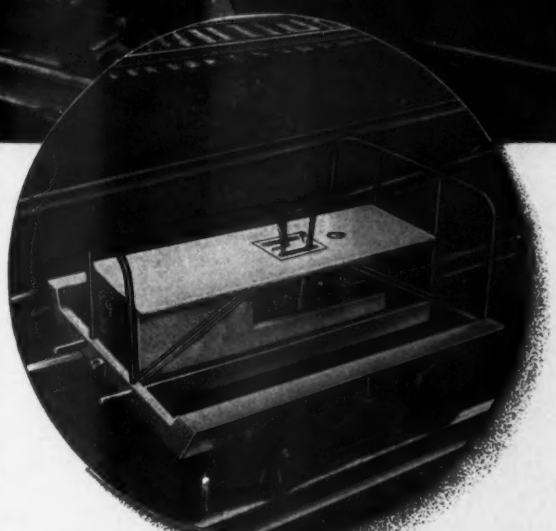
NEWEST addition to the modern, preferred line of Buda Motor Cars is the Buda "Sectionmaster"—a double duty car for small track crews with full equipment, or for carrying six to eight man section gangs. (1200 lb. load capacity.) This new car is strongly built, designed for section work with maximum safety for men and equipment. Its economy of performance (low oil and gas consumption, little maintenance) is unequalled for a light section motor car. Here are its exceptional features:

- **AIR COOLED 4-CYCLE ENGINE — Actually develops 7.7 hp. Easy to start. Maintains smooth, uninterrupted operation when both car and trailer are fully loaded.**
- **ONLY 95 LBS. REAR LIFT—Safe to operate. Easy to remove from track — patented skid rails, located 1 inch above rail head, prevent car from straddling rail.**
- **EXTRA LARGE TOOL AND EQUIPMENT SPACE —Long, wide deck for seating crew.**
- **TOWS TRAILER LOADS UP TO 4,000 LBS. — Equipped with special tow bar. (2-speed reduction gear available for heavier loads.)**

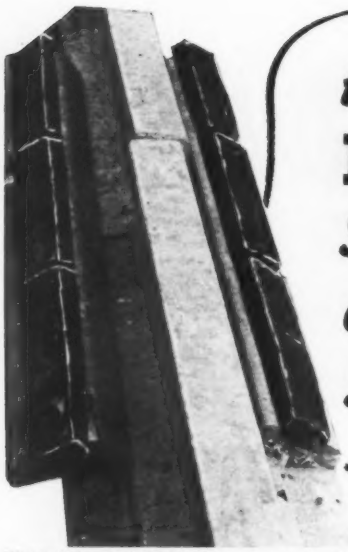


• Above are loaded and unloaded views of the Buda "Sectionmaster." Construction features include all-welded frame, rubber cushioned roller bearings, and 4-wheel self-centering brakes.

WRITE FOR literature on this and other new modern Buda Motor Cars.

THE BUDA CO.
HARVEY (Chicago Suburb) ILLINOIS

BUDA
ESTABLISHED
1881



Here's How
RMC PLASTIC
Simplifies Your Labor and Vital-Material Shortage Problems

Molded bars of RMC Plastic are placed on the inner faces of joint bars before bolting them to the rail. . .

The bolting action presses the plastic into every section of the joint assembly so that all fastenings and surfaces are thoroughly lubricated and protected. . . .

10 years after packing with RMC Plastic, joint assemblies are still 100% corrosion-free!

1. *IT SAVES STEEL:* By protecting the most vulnerable spots of rails, the joints, from all corrosive agencies, RMC Plastic increases rail life and practically eliminates parts-renewals.

2. *IT SAVES LABOR:* RMC Plastic reaches, protects, and thoroughly lubricates every joint fastening and surface. Joints cannot "freeze"—but can properly expand and contract—so that rail-end batter is reduced. Considerable labor that would otherwise be required for servicing frozen joints, for building up worn rail ends, and for replacing worn parts is, therefore, eliminated.

3. *IT PROTECTS FOR LIFE:* Only one packing of joints with RMC Plastic is needed to prevent corrosion during the service life of the rails.

4. *IT COSTS VERY LITTLE:* The low price of RMC Plastic enables you to specify its immediate use.

NO HIGH PRIORITIES on RMC PLASTIC
YOU CAN GET ALL YOU WANT WHEN YOU WANT IT

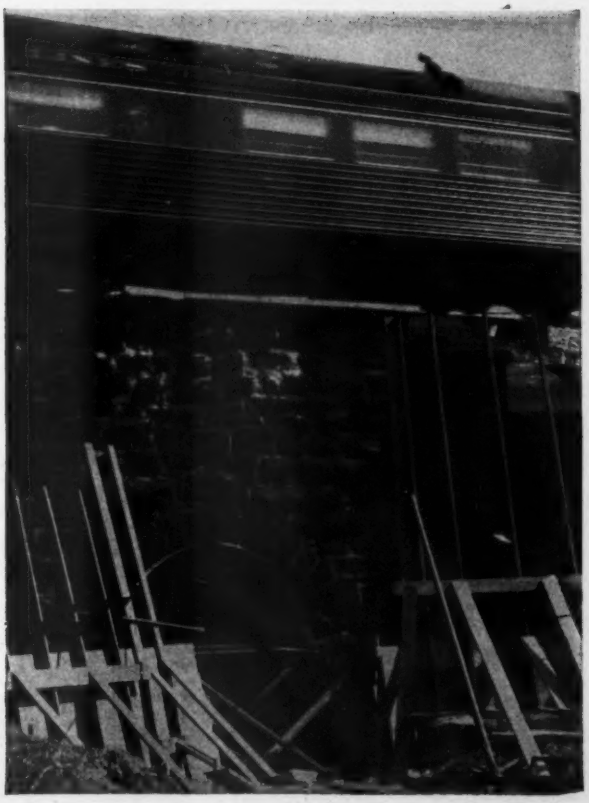
End CORROSION HERE

RAILWAY MAINTENANCE CORP.
PITTSBURGH **PENNSYLVANIA**

• Why let unsafe, budget-eating bridges, arches or boxes plague your war transportation efforts. With ARMCO Multi Plate you can keep the victory road open and aid national defense by speeding the delivery of vital goods.

Using ARMCO Multi Plate, you can reline or replace an average small bridge in a few days, without interrupting traffic. Your regular crew assembles the sturdy plate sections in any weather without special equipment. Then backfill and finish off with a headwall design you like. The result is a structure that has ample strength to withstand all railroad loading conditions.

Learn how quickly you can repair or replace your most troublesome drainage structures with ARMCO Multi Plate. A request will bring complete information. ARMCO Railroad Sales Co. Inc., 1521 Curtis St., Middletown, O.



ARMCO

ARMCO Multi Plate

PIPE AND ARCHES

TO RAILWAY SUPPLY MANUFACTURERS

"Lowers Costs"

"Boss, why do we spend so much for advertising?"

"That's a new one, Bill. Why do you ask that question?"

"Because a chief engineer asked it of me last week. Said the railways had to pay the bill in the end and it only ran up the cost of our product to them."

"That's an old one, Bill. And the answer's easy."

"What is it, Boss?"

"It's the rule of reducing costs through increasing production. Did you ever stop to think how much your automobile would have cost you if Henry Ford made and sold only 10 cars a day?"

"About three thousand dollars, I suppose, Boss."

"At least that. And what brought the cost down to $750?"

"Volume production, I guess."

"That's it. And that was made possible by volume sales."

"Yes?"

"And the automobile builders early discovered that volume sales were made possible only by widespread advertising."

"I see your point. Advertising increases demand and increased production lowers unit costs."

"That's it, Bill."

"So that, in reality, the money spent for advertising *lowers* rather than *raises* the cost of the product to the buyer."

"That's right—and it's true with our product too. We've been able to reduce our prices to our customers through the years because of the larger volume we're handling. If we did only a quarter of the business we're now doing, we'd have to charge twice as much as we now do."

"And that advertising in *Railway Engineering and Maintenance* helps us bring our prices *down*—Wait till I see that chief engineer again, Boss."

★ **Railway Engineering and Maintenance** Goes Every Month to the **Vice-President,** to the **Chief Engineer** and to the **Four Division Engineers** of the **Louisiana & Arkansas** Who Are in Training for Promotion to Supervisory Positions on This Railway. ★

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

FOR LONGER RAIL LIFE

Build Up Rail Ends By The Oxweld Method

• Rail life is greatly prolonged when battered rail ends are rebuilt with oxy-acetylene welding by the Oxweld method.

The special Oxweld welding rods used produce a deposit of metal which has a hardness considerably greater than that of the original rail. For this reason, the Oxweld method not only restores a true rail surface at low cost, but provides a protective armor which effectively retards subsequent batter.

Greatest economies can be effected with this method when rail ends are rebuilt before batter has progressed more than 2 or 3 inches back from the end. By rebuilding at this stage, wear and tear on ties, joint bars, bolts, and equipment—which increases more rapidly as batter continues to develop —is prevented or considerably reduced.

For programs of building up rail ends, Oxweld supplies high quality materials, dependable techniques, and supervision which assure uniformly good results.

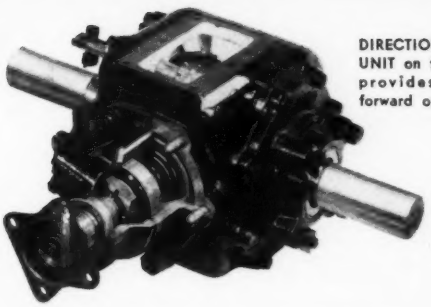
THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
Carbide and Carbon Building Chicago and New York

SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

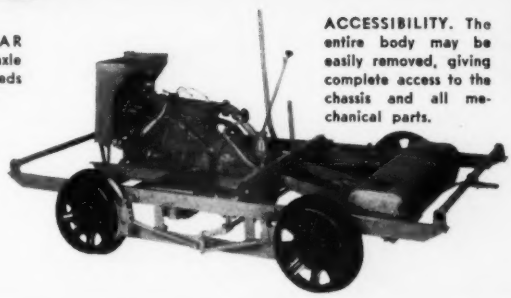
The word "Oxweld" is a registered trade-mark of a Unit of Union Carbide and Carbon Corporation.

Fairmont
GANG CARS

Performance ON THE JOB COUNTS



DIRECTIONAL GEAR UNIT on the rear axle provides four speeds forward or reverse.



ACCESSIBILITY. The entire body may be easily removed, giving complete access to the chassis and all mechanical parts.

CAN HANDLE THE HEAVIEST KIND OF HAULING AT SUBSTANTIAL SAVINGS IN OPERATING AND MAINTENANCE COSTS

For gangs of from 3 to 10 men and trains of from 1 to 7 trailers, Fairmont gang cars offer a broad choice as to load capacity, type of power plant, size of tool trays and other features. Four cylinder and eight cylinder engines with four-speed transmissions that offer a choice of 20, 36, 50, or 85 horsepower, are standard equipment. The heavily reinforced bodies and frames are bolted to insure flexibility for taking up stresses and strains caused by severe usage. For fast, economical maintenance, the bodies can be readily removed for quick access to engine and transmission. For minor adjustments the seat top and sides are hinged. Ask about Fairmont gang cars for your heavy hauling job. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

OF ALL THE CARS IN SERVICE TODAY *More Than Half are Fairmonts*

No. 161 of a series

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Advertising in a New Role

May 1, 1942

Dear Reader:

For years, alert manufacturers have used the advertising pages of Railway Engineering and Maintenance to bring to your attention the merits of materials and equipment designed to meet your needs. And you have found much in these advertisements to interest and help you. As a result, your use of their equipment has expanded greatly.

Suddenly, a number of these manufacturers face new and seemingly insuperable problems. Some are finding their supplies of necessary materials shut off; others have their output commandeered for war purposes. Regardless of the causes, they are suddenly finding themselves unable to meet your needs.

For the manufacturer so situated, this presents a difficult problem. The line of least resistance might, at first thought, be to reduce or eliminate his advertising—and thereby reduce the embarrassment of turning down your orders. But by so doing, he jeopardizes an asset of great value—the contact that he has established with you through the years.

Knowing how easily a firm or a product can be forgotten in these days of rapid change and recalling firms that, after the last war, passed into oblivion as a result of dropping from sight during that conflict, the alert manufacturer who faces inability to make deliveries today is adopting a different technique. Instead of deserting his customers cold, he is maintaining his contact with them through the printed page but is changing his message from one of direct sales appeal to an explanation of his problem and soliciting forbearance. Even more constructively, some companies are using their space to tell their customers how to carry on with their equipment and materials that they already have and thereby aiding them in carrying on until these suppliers can again meet the needs of their patrons. Illustrative of such helpful co-operation is the message of one company on "how to get the most from its equipment"; another is telling its clientel "how to make its appliance work like new". A paint company is fostering a plan to extend the life of paint and still another company cautions its customers to "be sure it can't be fixed before you replace it".

Through these means, manufacturers who face inability to meet the needs of their customers temporarily, and whose salesmen have been assigned to other duties, are doing what they can to aid these customers in carrying on until the conditions that are now beyond their control are cleared up. And through this means they are also retaining the good will of their customers and are maintaining their contact with these patrons so that these patrons will not forget them when conditions clear up. This is a new and highly constructive phase of advertising growing out of the present war that I am sure you and other buyers appreciate, and will appreciate even more if and when the situation that is so pronounced in some other industries becomes more acute with the advertisers in Railway Engineering and Maintenance.

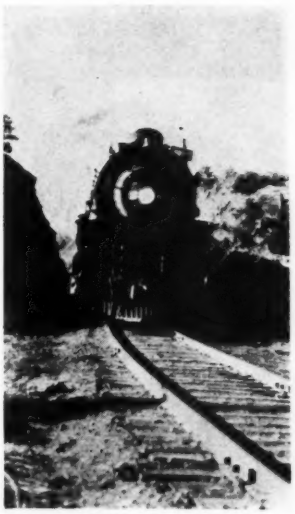
Yours sincerely,

Elmer T. Howson

ETH:EW

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.



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PRINTED IN U.S.A.

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

MAY, 1942

BE A

WASTE WARDEN

lend a hand to "Keep 'Em Rolling"

FOR VICTORY

UNCONSCIOUS waste in this land of plenty can become a serious handicap in our war effort. Let's take a case in point — oxygen. This element is vital to the speedy production of tanks, trucks, guns, ships, planes, and shells.

Oxygen consumption continues to skyrocket and the bottleneck remains steel cylinders. They just can't be obtained fast enough. But, we can all help by making every cylinder most useful. Here's how:

Make yourself a Waste Warden. See that the cylinders keep rolling. Don't let them get tied up in inventory. Be sure that cylinders are shipped back promptly when they are empty — and be sure to get the most gas out of each cylinder. If you see to it that these and other "do" and "don't" suggestions are followed you will be making a worthwhile contribution to our war effort as well as helping yourself.

Join the "Waste Wardens". Keep the cylinders rolling.

WASTE WARDEN SAYS:

DO close cylinder valve after use.
DO check your hose and connections for leaks.
DO keep inventory low.
DO return empty cylinders promptly.
DO keep tips clean and free from carbon and slag.

DON'T use excessive pressure.
DON'T use oversize tip.
DON'T leave tip burning when not in use.
DON'T abuse cylinders.
DON'T leave cylinder valves open when gas is not being used.

Air Reduction

60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS: MAGNOLIA-AIRCO GAS PRODUCTS CO.

AIRCO

WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

Railway Engineering and Maintenance

Maintenance Men

Are in the Service Now

"WE know where we would hang a medal, if we were hanging medals.

"And you will never guess.

"It would be on the chest of what too many of us had come to believe was a decrepit old veteran about ready to fall apart—

"The railroads of America.

"All of us have been inclined to criticize them for what we considered their lack of efficiency and indifference, and gossip had it that they were out-moded and incapable of handling modern problems of traffic, both freight and passenger, and under emergency pressure, would collapse.

"What a mistaken idea that was!

"Unsung, unacclaimed, without fanfare or boasting, they are doing the greatest transportation job ever known in the history of the world.

"They are moving troops and materials over mountains, across the plains and deserts, and tying coast lines together with an efficiency that is amazing.

"At the same time, passenger traffic is moving with greater comfort and speed than ever before and non-war freight is being handled as though that's all there was.

"If there ever was an institution completely and thoroughly in step with the war effort and needs of the United States.

"It is the railroads."

A Tribute and a Challenge

Thus read an editorial in a recent issue of the Kansas City Journal. And it was signed by the editor of that newspaper to give it maximum weight. It comprises a tribute that will warm the heart of every loyal railway employee—and nowhere more universally than in the maintenance of way department, for the men here have contributed to this record as directly and as fully as any other group in railway service. At no previous time have the railways rendered as much transportation service and handled it so efficiently as now—and at no time have they handled it as rapidly and with as great freedom from delays due to failure of tracks and structures.

But this record, splendid though it is, is not enough. More serious days are ahead—days that will present new problems that will be even more acute and that will call for still greater resourcefulness among maintenance men.

Efficient railway service constitutes a contribution to public welfare of a high order at any time. Its importance is vastly increased today when every activity bears a direct relation to our war effort. When so much of our traffic today involves the movement of ore or other raw materials to the mills, or the handling of parts of planes, tanks, guns and other combat equipment to centers for assembly, or the transportation of the finished units to our armed forces, the responsibility of the railways takes on the significance, in a very real degree, of the first line of support behind our armed forces. For this reason, every member of a maintenance gang, and every foreman or other officer who directs his efforts, in common with every other employee of a railway, is in a very real way in the nation's service and his suit or overalls become a service uniform.

The Need for Materials and Labor

Carrying such responsibility, maintenance men must face the future with determination. They must recognize that, even though the wear and tear of record traffic volume increase the need for replacements of vital materials, the demands of our military activities are so huge as to make it impossible to meet these railway needs in full, and that our war effort requires that we carry on with reduced materials, so conserving what we have as to increase their life to the maximum and maintain our standards of service. This will require greater care of rail and fastenings to retard and overcome deterioration and greater alertness to detect failures before they occur. It demands the conservation of tools to eliminate abuse and to stimulate repair. It necessitates alertness to develop substitute materials and willingness to accept them. In short, it requires a new conception of the value of materials to make them last longer and reduce the necessity for replacement.

In part, the responsibility for such measures rests with the supervisory officers; in even greater degree, it rests with the men in the gangs, for they are in daily contact with these materials in service and are in positition to take those measures that will arrest this deterioration at its inception.

And the maintenance man, especially in a supervisory capacity, faces another problem. This relates to labor.

Millions of men are being drawn into our armed forces, many of whom are coming from railway service. Others are being attracted into industries producing war materials. As a result of these and other influences, maintenance officers face a larger turnover in forces than ever before. It will be necessary to recruit and to train more new men. They will, of necessity, be inexperienced and require more direction. Their output may not approach that of the more highly experienced men available during the last decade. This condition will tax the patience and the ingenuity of the supervisor. Yet it is a part of the load he must carry as his part in the war effort.

This shortage in labor points to a number of expedients to get the maximum amount of work done. In the first place, it gives emphasis to the earliest possible start. Government authorities forecast that the number of men who will be required in the munitions and armament plants will rise rapidly during the spring as these plants come into operation and this will draw still more men from the railways. Any work that can be done on the tracks and structures in advance will be out of the way and its completion assured.

More Service from Equipment

Furthermore, a shortage in labor points to the necessity for the more wide-spread use of work equipment. The maintenance of way department has made rapid strides in this direction in recent years. It spent $10,500,000 for work equipment last year; it has invested more than $100,000,000 in all for this purpose. And its contemplated purchases this year are larger than ever before. While these plans may not be realized in full because of the inability of some builders to make deliveries, purchases from others are continuing at a high level. Even here, however, some shortage may be expected.

Since the output of any machine or group of machines is measured by the number of hours they are worked; some roads are this year preparing to increase the hours these machines are operated, either by extending the length of the shift or by working two shifts. Likewise, some roads are reducing non-productive time required for moving equipment back and forth in such operations as laying rail by purchasing two sets of equipment and working them simultaneously on the two rails or by leaving each set with its rail and moving the gang back more quickly. Regardless of the means, there is the necessity this year for securing the maximum production from men and equipment alike.

Selecting Work to Be Done

The conditions that now prevail necessitate a changed approach to the season's program in still another respect. After more than 10 years of restricted programs because of lack of money, the roads are now in the anomalous position of having adequate earnings to finance enlarged programs and then being unable to spend them for many of the materials they need, although there are no such restrictions on many other types of work, such as grading, for illustration. The present offers opportunity, therefore, to do more than the normal amount of bank widening, line revision, ballasting, etc., preliminary to the relaying of rail, in order to have these roadbeds ready for the rail when it again becomes available in adequate quantities. While this tends towards unbalanced programs for the present, the balance will be restored quickly when the present abnormal conditions pass and more improvement work will be done than would otherwise be possible.

In brief, maintenance forces face new conditions in many respects today. These conditions require new approaches. They will require many changes in established lines of thinking and in established procedure. But emergencies are not new to these men. They have long thrived on them. They work best when the going is hard. The ingenuity developed in past emergencies will stand them in good stead now. It is because of such versatility and such loyalty that the editor of the metropolitan newspaper quoted above was inspired to "pin a medal on the railroads." And maintenance men are determined to show that they merit it.

Roadway Machines—

Why Only One-Shift Operation?

EVER since work equipment became an important counterpart of many maintenance of way operations, maintenance officers have recognized the fact that its greatest benefits, not to mention the return on the investment, could be realized only by its most intensive use. To this end, many maintenance of way operations have been completely re-organized in recent years, equipment being concentrated largely in the hands of specialized gangs where it could be used to the best advantage.

However, in spite of the fact that maintenance men are subject to call 24 hours a day and recognize no limit of endurance for themselves or their equipment during emergencies, they have been prone to think of intensive use of work equipment in terms of an eight- or ten-hour day. That this general feeling prevailed during the depression period is not surprising, when appropriations and work programs on most roads were cut so drastically that there was insufficient work authorized to keep the available equipment busy for a single shift six or even five days a week. But this situation has changed—programs have been greatly enlarged and promise to be at a peak during the coming summer; with still further defections from the ranks for the armed services and for work in defense industry to be expected, labor skilled in maintenance work is bound to be at a premium, in spite of measures to the contrary; and on top of this, and in spite of the large purchases of work equipment in recent years and purchases planned for the present year, equipment will be none too plentiful to carry out the work at hand.

Faced with these conditions, and especially where they promise to interfere with the completion of essential programs, many maintenance officers will, undoubtedly, want to study the possibilities of two, and even three shifts for certain of their units of equipment during the coming working season. That this possibility for the more intensive use of maintenance equipment has not been overlooked entirely, and, in fact, has already demonstrated its practicability for certain operations, is seen in the experience of the Great Northern, which for several years has been double- and triple-crewing some types of its equipment in the interest of economy and of completing

the maximum amount of work during the restricted working season that prevails in most of its territory.

In an extensive program of line rehabilitation, including ditching, bank widening, general right-of-way sloping for drainage and to simplify machine mowing, this road has found its tractors and supplementary grading equipment particularly adept to two- and three-shift operation. With illumination furnished for the most part by floodlights mounted on and powered by the equipment itself, these operations have been carried out practically as effectively at night as during the daytime. It has also found it profitable to double-crew the tie saws employed with its large tie renewal gangs, securing double production from each machine, and, incidentally, preventing delays to the operations of the main tie renewal forces. In addition, it has double-crewed its electric welders in the repair of manganese steel trackwork, speeding up production, while at the same time realizing the greatest return on the investment in the equipment.

While the types of equipment mentioned, with small, self-sustained crews, appear to offer the best possibilities for multiple-shift operations, there would seem to be equal possibilities under some circumstances in the more intensive use of heavy ballast cleaners, ballast scarifiers and discers, draglines, shovels and cranes, and even such equipment as power bolting machines in routine bolt-tightening operations. If there are advantages to be gained in this regard, maintenance men will not want to overlook investigating their full possibilities this year.

Specialized Gangs—

Their Place in Routine Maintenance

LESS than twenty years ago, a committee reporting to the Roadmasters' Association suggested the idea of extending section limits and of using extra gangs for routine maintenance. At that time power machines and tools were in the early stages of development and their use was not widespread, for most roads had no such equipment or only a few of the machines then available. Although the report aroused lively interest at the convention, it was soon forgotten, for the time was not yet ripe for so radical a change in the practices of the day.

As rail increased in weight, the difficulties and hazards of laying it manually eliminated the division rail gangs and concentrated this work in regional or system rail gangs that were equipped with rail cranes. The rail crane could set the rail into the track so rapidly that more men became necessary to keep the remaining operations synchronized with the actual laying, and the gangs became unwieldy. Out of this situation came the spike puller, the power track wrench, the tie adzer, the spike driver, the power drill and other machines and tools for accelerating the various operations connected with laying rail. It soon became apparent that the division surfacing or ballasting gang could not keep pace with a fully mechanized rail gang, and it, too, gave way to the specialized surfacing gang, to insure that the new rail would not be damaged by traffic through failure to surface it quickly.

This experience soon demonstrated that specialized and fully mechanized gangs have many advantages, compared with widely separated local extra gangs, and the next step was to extend their operations to routine surfacing, to tie renewals, to tightening bolts, to building up battered rail joints and to other items of enough magnitude to keep them employed over a sufficient period to warrant their organization. While these developments were taking place, sharply shrinking revenues demanded drastic reductions in force, and out of this came the longer sections which the committee had recommended a decade previously.

Although these changes occurred more quickly and were more radical than any that had preceded them, they did not take place spontaneously or at one time; only a few pioneered. Many maintenance officers were not convinced that the established practices needed revision; others could see no reason for taking routine operations out of the hands of the section forces where they had reposed from the beginning of the railways; and still others were merely reluctant to change their practices. In fact, not a few alert maintenance officers are still not convinced that there are advantages in specialized gangs, except for laying rail and ballasting.

Economic pressure is inexorable, however, and the specialized gang has demonstrated its economy and has shown that it is capable of doing work to the same standards as the section forces, provided it is supervised adequately, while the output per man-hour is enough greater to justify its existence if other justification were not forthcoming. Obviously, it is easier and cheaper to keep two or three specialized gangs that are progressing according to predetermined schedules, supplied with ballast, ties or other material, than it is to deliver the same supplies to 15 or 20 widely separated extra gangs or an equivalent number of section gangs, none of which is moving forward at a regular rate.

It should be equally obvious that no localized gang that must depend largely on manual methods or that is interrupted from time to time to attend to other duties, can compete on the basis of either unit cost or output with a fully mechanized gang that has no assignments other than the work in hand. On the other hand, there must be sufficient work in sight to keep the gang busy long enough to warrant the assignment of the power machines, the camp equipment, the boarding facilities and the foremen that will be needed during its existence. Otherwise it will be a liability rather than an asset. Again full consideration should be given to the character of the work to be done; if tie renewals are too few to the mile, the gang may spend a disproportionate amount of time traveling forward and will be unprofitable; if the surfacing is in short stretches with wide gaps between, local gangs may be able to do the work at less cost than larger specialized gangs.

Few doubt that the specialized gang is here to stay until new developments displace it. It can be fully mechanized and can use its equipment intensively. Against this, the cost of mechanizing an equivalent number of smaller gangs is prohibitive and, because these gangs have other duties, they cannot use the equipment a sufficient time to make a profit on most of the types they would need. However, as in other things, judgment must be used in deciding on the organization of specialized gangs. Their success depends on mass production and, if the work in view is not of such a character or is insufficient in volume to make this type of work possible, the specialized gang will not be profitable.

Scarcity—All

What Can

"I Do Not Want to Suggest Welding As A 'Cure All.' It Is Not, But I Know of No Way in Which Money Can Be Spent in Track Maintenance to Give As Large A Return"

"Proper Care Begins When the Rail Is Being Unloaded on the Job. Cranes or Other Suitable Methods of Handling Should Be Used — A Workmanlike Job of Laying Is Absolutely Necessary"

Track Forces Have Many Opportunities to Conserve*

By H. R. Clarke

Chief Engineer Maintenance of Way
Chicago, Burlington & Quincy, Chicago

CARELESSNESS, waste and inefficiency cannot be condoned at any time, but they are absolutely inexcusable under some conditions. If earnings are large, with everything moving smoothly and no emergencies of any kind pressing, carelessness and incompetence may be offset by spending more money for labor and material. In times of difficulty, however, when earnings are at low ebb and no money is available for "second guessing," as has been the case for about 10 years until recently, every move must count. In times such as now confront us, when, regardless of cost or effort, material cannot be secured, there must be no waste, and every possible means of conservation and saving must be resorted to. What can we do about it?

*Abstract of an address presented before the fifth-sixth annual convention of the Roadmasters' and Maintenance of Way Association, in Chicago, on September 17, 1941.

Must Preserve Tools

Since scarcity exists all along the line, we must consider every item we use or are responsible for in any way. Speaking first of track tools—we can and will see that they are not abused or mishandled in any way. Track shovels were not designed to serve as lining or nipping bars, and should not be used for those purposes. Claw bars should not be driven onto spikes with spike mauls, with consequent damage. Track jacks should not be bent, broken and made unserviceable by trying to lift loads beyond their capacity. Care should be exercised to make sure that tools are not lost in the weeds or covered up in the ballast, and at all times they should be protected against theft, both to conserve them and to prevent sabotage.

Tools should be used to the economical limit. That does not mean we should continue to use a shovel, tamping fork, spike maul or adz when it is no longer efficient, or when it becomes unsafe for any reason, but that we should use them to the limit of their efficiency. In some cases, after tools can no longer be used to advantage on main-line track with heavy rail, large ties, and ballast that is difficult to work, they can be used quite satisfactorily on lines of lighter track construction, and they should be used in that way to get the fullest service from them. Also, tools so worn that they are no longer useful for their original purpose, are sometimes highly suited for some other job. For example, tamping forks, worn too short for tamping, make excellent tools, when the ends of the tines are bent, for cleaning out ballast ahead of adzing machines. All tools when worn out, broken or otherwise rendered unusable, should be sent in to designated repair points so that, if possible, they can be repaired and reissued for use—or, in any event, so that any useable part or material can be salvaged.

(Continued on page 338)

Along the Line

We Do About It?

With scarcity of materials, tools and equipment confronting the track and bridge and building forces on every hand, the authors of these two papers not only tell them what they can do about it, but what they must do about it if they, in the face of the difficulties ahead, are to be successful in maintaining their tracks and structures to the higher standards being called for today

Bridge and Building Men Must Play Their Part†

By G. A. Haggander
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THE situation as regards materials for bridge and building maintenance is changing so rapidly that it is impossible to go into detail as to what we can or should do about it. However, there are a few general principles which can be observed largely formed from experiences during the first World War.

At the present time, with railroad earnings generally much better than they have been for a number of years, these earnings should be appropriated generously for restoring our properties to first-class condition. We should do all we can before the shortage becomes more acute. In any case, we should take care of certain replacement and repair work, such as bringing our painting up to date, and, in general, do all we can toward eliminating any deferred maintenance.

It is now necessary to anticpate requirements for materials much further in advance than has been necessary ordinarily. Essential items of machinery, equipment, steel products, etc., must be ordered months in ad-advance. Requirements for new structures should be reduced so far as possible by making heavy repairs to existing structures, or by making partial renewals. Trestles can be repaired by driving helper piles and by making partial renewals of caps, stringers, ties, etc., beyond the point usually considered economical. We have found it desirable on our road to renew enough wood pile trestles to provide sufficient second-hand repair material for the balance of such trestles, thus concentrating new material in new structures.

The matter of heavy repairs to steel structures is especially important, since the necessary materials for such repairs are now more difficult to obtain. These structures can be repaired or strengthened by adding or replacing cover plates, bracing, and other details, or by placing them on falsework, where this is permissible.

Substitute Materials

When mentioning the repair of steel structures, it is well to remind one of the possibilities through the use of arc welding, which will allow repairs to be made in many cases which would otherwise be uneconomical. Another method of meeting emergencies is to use substitute materials. In many cases it will be necessary to build structures of timber or reinforced concrete, instead of steel. During these times we can justify much longer spans of reinforced concrete than has been the case ordinarily, because of the comparatively small amount of steel required. The other ingredients—cement and aggregates—are nearly always available. During the first World war it became economical to build reinforced concrete beam spans approximately 40 ft. in length, in place of employing steel; but with the reduction in the price of steel later, the economical length was reduced considerably.

Considerable material can be salvaged by abandoning unprofitable and unused lines, multiple tracks, or any other trackage that is not required. While the abandonment of tracks is not a direct function of the bridge and building department, those in this department are often familiar with local conditions concerning the use of

"The Matter of Heavy Repairs to Steel Structures Is Especially Important—These Structures Can Be Repaired or Strengthened by Adding or Replacing Cover Plates, Bracing and Other Details

†An address presented before the forty-eighth annual convention of the American Railway Bridge and Building Association, in Chicago on October 15, 1941.

tracks and can bring them to the attention of their superior officers. Another way to help in the matter of salvage is, of course, to keep the scrap on hand to a minumum, and to ship in salvaged or unused material promptly.

During these times, it is necessary to conserve tools and equipment. They should be programmed to work full time and should not be allowed to lie idle unnecessarily. Greater care should also be taken of equipment to avoid unnecessary wear or damage. I know of several cases involving the use of company automobiles, where, because of the increased difficulty of securing replacements, those responsible are limiting the speed of their cars to 40 or 50 m.p.h, instead of the usual 60 or 70 m.p.h , in order to prolong their life.

Keep Abreast of Repairs

It is also necessary to keep well abreast of repairs, to avoid long delays when they are actually needed. Machine parts seem to be one of the items which are especially difficult to secure, largely because of the fact that those companies producing them are working to capacity to fill orders for others, or have converted their plants to other purposes. Last week I saw a machine valued at probably $40,000 to $50,000, which is tied up for lack of a gear. The builder of the machine had converted his manufacturing facilities to other use, and could not cut the gear required. As a result, it has been necessary to redesign the gear and pinion, and secure two complete castings to replace the broken one, with, of course, long delay.

Another thing which we will have to watch carefully is the possible shortage of creosote, which was especially serious during the last World war. At that time we used certain chemicals and water gas tar as substitutes, with rather poor results. It is probable that the present extensive use of creosote-petroleum mixtures is holding the demand for creosote down to a point where the amount necessary can be obtained. During the earlier war it was necessary to use untreated timber and piling extensively, a situation which I trust will not develop during the present emergency.

It is, of course, necessary to conserve the use of cars and locomotives in company service, in order to make them available for revenue traffic. This, no doubt, is being emphasized and impressed upon you continually. However, it is more than likely that you are experiencing difficulty in keeping this matter before you because of practices that have grown up during the last few years, when equipment was plentiful. It is, of course, important also that maximum efficiency be developed in handling your work. This is another matter which I am sure is being brought to your attention often in a routine way, but which is especially important at a time like this, when every possible effort must be made to conserve labor, material and equipment.

Track Forces Must Conserve

(Continued from page 336)

Fully as important as any of the above, we should not order tools that are not needed, and tools no longer needed should not be allowed to lie unused in tool houses or on tool cars. When a job is finished and the force is reduced, or when tools are released in any other way, they must either be transferred to some other point where they are needed, or be returned to the stores department so that they may be reissued when and where they are needed.

Work Equipment

In handling work equipment of all kinds, including track motor cars, it is our responsibility, as never before, to keep it working to full capacity and to get all the production possible. Work can be planned and scheduled so that this can be done. Equipment must not lie idle. If it is located at a particular place or on some special job where it cannot be used to advantage, report to this effect should be made, and it should be transferred to a place and job where it is needed and can be used. This is no time to be selfish.

We must also do everything we can to keep equipment in good working order. Discuss the condition of your equipment with your operators and see that they handle it efficiently. Find out what repairs are needed, and arrange through proper channels to order them before a complete breakdown occurs. This will reduce the cost of repairs and will certainly avoid delays to your work.

The mention of equipment brings to mind cars and locomotives, and in this regard I wish to emphasize the great importance of preventing delays to cars, loaded or empty, in every way that we can. We trackmen use thousands of cars and many locomotive-days in handling maintenance-of-way material. I am sure that you have all read Ralph Budd's remarks addressed to shippers, stressing the great importance of handling and releasing cars promptly, and stating what it would mean in increased car supply if a delay of one day per car could be avoided. This would be equivalent to adding 99,600 cars to the nation's supply. We must do our part and set a good example.

Protect Ties

When we consider materials, we might well take the first item in the track structure—ties. Already there has been a decided increase in the cost of ties, and they are becoming more and more difficult to get. The expense item in Account 212, Ties, has always been one of the largest in maintenance-of-way cost accounts, and here we have a great opportunity to save money and conserve material. To do this, tie renewals should be checked most carefully.

The track structure must be kept safe; therefore, very likely, increased traffic may make necessary, and increased revenue may make possible, more liberal renewals. But even in this event, no good ties should be removed from the track, and, if for any reason a serviceable tie is taken out, it should be used again in a place where further service can be secured from it. Furthermore, to prevent deterioration and consequently shortened life of any such ties, they should be reused as soon as possible.

When ties are shipped out on the line, they should be unloaded promptly. Also, they should be piled as called for by standard instructions so that the preservative chemicals in them will not evaporate or leach out. The necessary precautions to protect the ties from fire and theft must also be taken. In handling ties, from the tree to the track, care should be used to prevent damage or abuse that will shorten their service life.

Get Most From Rail

Steel is one of the most important war materials, and we know of the restrictions that have been placed on its use and the difficulty in securing it at all. When we know that one mile of 112-lb. rail requires 176 tons of steel; that a mile of 131-lb. rail requires 206 tons; and that the tie plates, and angle bars, bolts, spikes, anchors, and other fastenings required to lay a mile of rail weigh not much less than half the rail tonnage, we realize what an immense amount of steel is used in track construction and maintenance, and we properly ask ourselves the question—What can we do about that?

The first responsibility in this re-

gard rests with the rail manufacturers. They must give us good material, that is, rail and fastenings of the best possible quality, and must not allow the present emergency to serve as an excuse for supplying inferior material. I believe the rail mills are doing their part, so that it is then up to us to insure in every way the maximum service life from this material. Proper care begins when the rail is being unloaded on the job. Cranes or other suitable methods of handling should be used so the rail will not be bent or damaged. A workmanlike job of laying is absolutely necessary, and the new rail should be smoothed up promptly to prevent its being damaged under traffic. With our present heavy rail sections, large double-shoulder tie plates, large ties, and a substantial ballast section, rail should be laid with less expansion than is generally used. I suggest that present expansion tables be revised, using practical experience instead of an arbitrary formula. This will reduce maintenance costs and save material.

Make Most of Welding

After the rail has been laid correctly, proper maintenance is necessary to insure good riding track and to reduce wear and tear on the material. There is a difference of opinion as to the value of rail-end hardening, but all are agreed that rail-end batter should be held to the minimum, especially on high-speed lines. The great progress made in recent years in the art of welding makes this possible, and every roadmaster should take full advantage of the savings that can be made. If his organization is such that he cannot control the welders himself, he should bring to the attention of the proper officer any bad condition developing, and should not be discouraged or quit if his first request does not bring the desired results. Good rail maintenance requires proper bolt tension at the joints, and this every roadmaster can control if he fully appreciates what it means and is determined to obtain it.

Another and rather recently developed process which cuts costs and greatly reduces the amount of steel needed, is the reclamation of angle bars by reforming. This process produces a bar fully equal to a new one, and superior for some purposes in that in the reshaping process the bar may be oversized or crowned for use on worn rail. We should take full advantage of this process.

The old-time practice of "busting" track nuts off with a maul is not feasible with the high-tensile, heat-treated bolt in general use today and, if bolts are kept in the shape they should be, by oiling, this practice need not be resorted to. Properly oiled bolts cannot only be tightened more easily, but their removal, particularly with a power wrench, is not difficult, and when done properly, a large percentage can be salvaged and reused, especially on secondary lines and sidings.

In the maintenance of railroad crossings, frogs and switches, costs can be greatly reduced and much material conserved by welding. We should take full advantage of this. Also, it is of great importance in the maintenance of this special trackwork, from the standpoint of both safety and savings, that bolts be kept tight.

I do not want to suggest welding as a "cure all." It is not, but I know of no way in which money can be spent in track maintenance that will give as large a return. However, I wish to sound the warning that it must be done properly and expertly; or the work is worse than wasted.

"Any Material Left Over or Released . . . Must Be Transferred Promptly to a Location Where It Is Needed or Shipped In to the Stores Department"

Pick Up Scrap

Another thing we can do is to insist that scrap of all kinds be picked up daily and shipped in frequently. It is surprising how quickly scrap accumulates, and I suspect that the amount that could be picked up on almost any section of track or right of way would astonish the supervisory officer in charge.

In connection with our efforts to make all scrap available, and in spite of the fact that some may think it somewhat beyond our jurisdiction, I suggest and urge that every maintenance officer be on the alert to note, and prompt to point out, unused tracks which he thinks might be taken up. The final decision in this regard is not made by us, but it is to the advantage of the maintenance department to get rid of every unneeded facility and so avoid any need for its maintenance. It may be high treason to hint as much, but I shall take the chance and suggest that transportation officers are very reluctant to give up any facility; therefore, let us help them to do their job, and call attention to tracks or other facilities that seem to be unessential.

The mention of shipping in scrap reminds me that nothing has been said as yet about shipping in usable material. We have all seen, both on our own railroad and on others, much usable material that evidently had been lying around for a long time, and probably inquiry developed that it was not planned to make use of it soon. That condition has always been wrong, and now it must not be allowed to exist. No supplies of any kind, tools or materials should be ordered out of the storehouse until it is certain they can be used promptly. Any material left over or released from the work being done must be transferred promptly to a location where it is needed, or be shipped in to the stores department. This is important, even if the material is unusable, as scrap is vitally needed to enable steel mills to keep production up to capacity. It is still more important in the case of usable material, as an important job on your own railroad, perhaps on an adjoining roadmaster's territory, may be delayed for lack of the very items which you are allowing to lie around, rusting and unused. The excuse that you may need it at some time was never very good, and now it is worthless. I repeat, this is no time to be selfish.

While I have said that material and tools should not be ordered until needed, I urge that you assist those charged with the responsibility of having material available when wanted, to do their job, which is a difficult one now, by advising them as far in advance as you can of any unusual need you may be facing for material. Let's help the purchasing agent by telling him through the proper channels what we expect to need and about when we will need it.

For years, to a large extent, we have done all of the things I have mentioned. They are recognized as good maintenance practice and good railroading. Heretofore the main reasons advanced for these methods were efficiency and economy. Now we have another, still more compelling, reason—to save tools, equipment and materials in every way we can. We can do a great deal about it, and we are going to do it

Stone Ballast on the Erie Is Cleaned With Moles at Intervals of Four to Six Years.

Ballast Gets Special Attention on the Erie*

By H. J. Weccheider,
Division Engineer, Erie,
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On this road great emphasis is placed on the desirability of keeping stone ballast clean and of maintaining the proper ballast section. In his paper, Mr. Weccheider gives the reasoning behind this policy and then describes the methods, gang organization and equipment that are employed in putting it into practice. Also he explains how the ballasting and resurfacing operations are coordinated with other maintenance work to produce track that will require a minimum of attention and maintenance expense for years to come

EVERYONE will agree that the increased axle loads and speeds of traffic have made necessary higher standards of maintenance. Heavier wheel loads have shown the necessity for using stone ballast, and the economy resulting from the maintenance of a clean ballast bed has also become recognized. In fact, the cleaning of ballast has become so important that it is one of the last of our activities to be curtailed when a reduction in expenses becomes necessary. We know that ballast which has become fouled must be cleaned in order to function as intended. Track having clean ballast will go through the winter in much better condition than if the ballast is foul, and less attention will be required to take care of surface deflections or heaved locations. When cleaning ballast, it should be cribbed and then cleaned on the shoulder and in the intertrack space to a depth about level with the sub-grade.

One of the principal requirements of good maintenance is adequate drainage. Also, the roadbed should be of sufficient width to support the track and to provide full-width ditches in cuts. We have frequently found it necessary to strengthen the roadbed by widening it, and to provide drainage ditches or to install sub-drainage systems for lowering the water table and drainage of water pockets. Adequate roadbed drainage, combined with clean ballast, helps to produce smoother-riding track, and reduces the frequency with which the track must be lined and surfaced.

*A paper presented before the Metropolitan Maintenance of Way Club, New York.

Need for Periodic Cleaning

In any stone-ballasted track carrying heavy, fast traffic, a compact and unyielding ballast condition will develop in four to six years after it has been given an out-of-face ballast raise. This kind of track will then lose its spring or resilience and in time will become centerbound. It will tend to acquire "choppy" riding qualities, regardless of the kind of stone ballast that is present under the ties. Periodic spot tamping will not alone produce good-riding track; it is necessary periodically to program certain locations to receive out-of-face reballasting or resurfacing raises. Only in this way can we bring back the uniform conditions which will afford strong, smooth-riding track. In connection with this work, the ballast should be cleaned.

Each year on the Erie we have large programs of work involving our stone ballast. One of the programs consists of what is called reballasting, which is divided into 3-in. and 5-in. raises. The 3-in. reballasting raise is used under ordinary conditions, while the 5-in. raise is made where the ballast is exceptionally muddy, or where one track is lower than the other. In connection with the 5-in. reballasting programs, profiles are run, ballast stakes are set and any existing sags are raised out. The track is reballasted at all locations where new rail is laid. At the majority of these locations, we are replacing 110-lb. rail having a two-tie joint, with 131-lb. rail having a three-tie supported joint. This requires the respacing of all of the ties because of the difference in the joint spacing and also because our main-line track is provided with 24 ties per 39-ft. rail length when it is worked

over. In this connection we do not renew the rail in any more track in a given month than can be reballasted immediately.

Another of the programs consists of the resurfacing of the track. This work entails a light out-of-face raise and is carried out under old rail where it is not necessary to respace the ties, and where, because of general ballast or tie conditions, a light ballast raise is sufficient. In such locations the ballast is also cleaned.

Our reballasting and resurfacing programs are applied to any given stretch of track at intervals of from four to six years. On all work of this kind the track is cribbed and the ballast is cleaned with "moles." Occasionally, we may lay new rail in track that has had a resurfacing or reballasting raise and the ballast cleaned one to two years previously, in which event the track is raised and tied without cleaning the ballast. However, as a rule, all of our reballasting and resurfacing jobs involve the cribbing and cleaning of the old ballast in advance.

Organization Standardized

In both the reballasting and the resurfacing work, we use a standardized organization. We have found that a balanced organization lowers costs and improves the quality of the work. At the present time, we crib the track on practically all of our jobs with a power cribbing machine and, because of the economy of cribbing by this method, we work the cribbing machines two tricks. For supervising the work of each of our standard reballasting gangs, we have one extra-gang foreman, who has general supervision over the entire operation and who is in direct charge of the work of making the final raise; one assistant foreman, who is in charge of the cribbing machine or the hand-cribbing gang, as the case may be; and one assistant foreman, who has supervision over the tie gang. There is also an assistant foreman in charge of each "mole."

A total of 44 trackmen are used in this organization, which is composed of separate gangs for cribbing the track, cleaning the ballast, renewing and respacing the ties and reballasting and raising the track. The cribbing gang is started first and remains some distance ahead of the tie gang in order not to interfere with that organization. Similarly the other gangs in the organization are so spaced relative to each other that there is no interference between them. The organization thus started is a balanced one and the work progresses smoothly, with all gangs evenly spaced. To keep this balanced organization working smoothly, it is necessary for the supervisor to see that such material as ties, spikes and ballast is distributed properly so that no time is lost by the extra gang because of the necessity of stopping its regular functions to redistribute needed material.

Cribbing

Where cribbing is done by hand the gang organization for performing this work consists of the assistant foreman and 13 men. As mentioned above, however, practically all of our cribbing work is done with a power cribbing machine, in which event the cribbing gang is reduced to one assistant foreman, one cribbing-machine operator, two trackmen and one flagman.

Incidentally, the use of the cribbing machine results in a considerable reduction in the cost of the work. While this machine is apparently of recent introduction, it has proved very satisfactory on the Erie. It weighs approximately thirteen tons and is self-propelled in both directions, operating at a cruising speed of 18 miles per hour. The machine is equipped with power-operated transverse set-off wheels, and can be removed from or returned to the track in approximately four minutes by the standard organization. It is also equipped with four hydraulic jacks for lifting it, which are operated from the top of the rail.

The fouled ballast that has been cribbed to the shoulder and the intertrack space is then cleaned with two "moles," one working in the intertrack space and the other on the shoulder. Each "mole" has a separate organization, consisting of one assistant foreman, one operator, and four trackmen when working in the intertrack space or three trackmen when cleaning the shoulder ballast. The "moles" are transported from one location to another on special push cars and a demountable derrick is used for loading and unloading them, one of which accompanies each "mole." This derrick fastens to the head of the rail and is equipped with a six-ton hoist. The use of push cars for transporting the "moles" eliminates the need for work-train service for this purpose and thereby helps greatly to reduce the cost of cleaning ballast.

Other Operations

After the "moles" comes the gang that spaces and renews the ties, which consists of one assistant foreman and 13 trackmen. In the wake of this gang, the necessary ballast is distributed uniformly from Hart convertible ballast cars, and the track is raised. For the latter operation, the gang comprises the extra gang foreman and 10 trackmen using tamping forks. Six trackmen then perform the final operations of levelling off the sub-grade and dressing the ballast. This organization includes one man carrying water and one flagman when necessary. After a few weeks, the final spotting up of any deflections that have developed is done by a small section gang.

An accurate record, involving weekly reports, is kept of the operations of these gangs, and the progress of each gang is watched closely and compared with that of other similar gangs. By computing the output on a

One of the Power Cribbing Machines That the Erie Uses in Connection With Its Ballast-Cleaning Work.

lineal-foot and man-hour basis, a good check can be kept on the efficiency of the gang operations.

Tie-Tamper Work

Our yearly maintenance effort also includes what is known as the tie-tamper cribbing program. This work is performed at locations, involving old rail, where out-of-face respacing of the ties is not required and where tie renewals are light. Generally the ballast at these locations is foul and the track requires smoothing up. These jobs are made ready for the tie-tamper operation by first cribbing the track with the power cribbing machine, cleaning the ballast with the "moles" and renewing what ties are necessary.

Ballast is then unloaded lightly and the track is given a uniform 1½-in. to 2-in. raise with a 12-tool (pneumatic) tie-tamper gang, organized as follows: One extra gang foreman, who sights the track and has general supervision over the gang; one assistant foreman who handles the level board and checks the actual tamping and filling in of ballast; one operator in charge of the tie-tamper compressor and who assists in moving pipe when necessary; 12 trackmen operating tie-tamper guns, 8 on the outside of the rails and 4 on the inside; two trackmen operating the jacks, of which 8 to 10 new-style low jacks are employed; two trackmen who keep the cribs properly filled ahead of the tampers, and handle the hose; two trackmen tightening bolts, driving down spikes and adjusting rail anchors; and two trackmen assisting the compressor operator in moving the pipe. To summarize, this gang consists of a foreman, an assistant foreman, an operator and 20 trackmen, and works over approximately 1,050 ft. of track per day.

Careful Work Required

In this organization, it is necessary that the track be sighted carefully for the raise, and that a close check be kept on the tampers to be sure that a uniform job is performed and that the ties are tamped under the rails. To insure a uniform tamping job, it is important that the ballast be distributed and forked evenly. All track that is reballasted and resurfaced in any year is gone over with the tie tampers the following year, using the organization described above except that it is not necessary to crib the track or clean the ballast.

Our tie-tamper compressors are worked from set-offs by using with each compressor 3,000 ft. of 2-in. pipe equipped with either Fons or Simmons Flexible pipe couplings so that the pipe can be moved quickly from one location to another by removing the coupling pins on every second length of pipe. The pipe is moved on push cars by two laborers and the compressor operator. For maximum efficiency in tamping MT-3 low-pressure type guns are used.

Weekly reports are submitted covering the operations of the tie-tamper organization. These reports give the number of feet of track tamped during the week, and show the time that the gang was idle, which includes delays occasioned by the passage of trains, bad weather, moving the hose connections, etc. With this data in hand, it is possible to compute the number of feet tamped per tool per hour of actual working time.

Ditching and Bank Widening

Wherever ditching and bank-widening work are contemplated, they are co-ordinated with the surfacing and reballasting operations, i. e., any cut-widening or bank-widening work that is to be performed within the limits of a track-raising job is carried out during the same year.

Our ditching is done in various ways. Where a cut is heavy the work is performed with a Diesel-powered ditcher mounted on a flat car, which deposits the excavated material in air-operated dump cars. Bank widening is also handled in this manner. At locations where obstructions interfere with the operation of a ditcher, locomotive cranes are used, also loading the material into air-operated dump cars. If two cranes are used in a work train, the cost of the work is naturally reduced. When wires or other obstructions interfere with the operation of ditchers or cranes in shallow cuts, the ditching work is performed economically by Diesel-operated bull-dozers which push the material to the ends of the cuts, where it is used to strengthen the adjoining fills.

Material that is loaded into dump cars from cuts is used on the bank-widening jobs, but when the ditching operations are too far removed from the bank-widening work to permit this to be done economically, the widening is done with cinders that are hauled in flat-bottom cars in a work train including two locomotive cranes for unloading purposes.

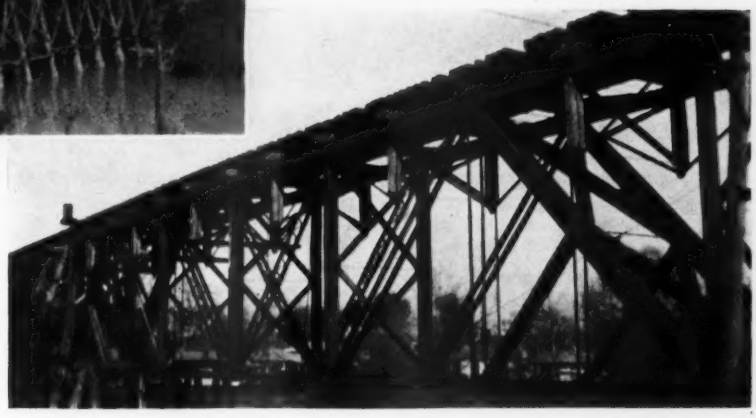
Each year we have a regularly-assigned program in which the spreader car is operated over the entire territory, cleaning out and shaping all ditches where the clearances will permit. This work, which is generally done in the fall, helps to control vegetation and provides clean ditches, placing them in condition to handle the spring flows.

Ballast-Shaper Car

In connection with the dressing of stone ballast, we operate a specially-designed ballast-shaper car over the entire territory each year. By purely mechanical means, this car straightens the stone line and gives the proper shape to the ballast section. The use of this car has greatly reduced the cost of dressing ballast and, in addition, allows us to keep all of our stone ballast lines in a neat condition.

All of our maintenance operations are carefully programmed and when a season's program has once been made it is adhered to. Also, the programs for laying rail, reballasting, bank widening, etc., are so co-ordinated that any piece of track that has been worked over comprises a section of standard railroad in every respect. Barring unusual circumstances, no heavy maintenance work will be required by this piece of track until its cycle has expired.

One of the Tie-Tamper Gangs That Are Employed in Out-of-Face Surfacing Operations.



For 25 Years a Combination, Iron and Wood Truss Span 150 Ft. Long Over the Oconee River on the Georgia Railroad Was Carried on a Pile Trestle as Shown in the View to the Left. Below—The Oconee River Span Today, Rehabilitated and Strengthened

Restores Bridge to Service After 25 Years

Since 1914, a combination iron and wood truss span, 150 ft. long, on the Georgia Railroad had been supported on falsework in the form of a timber trestle because it was felt that the heavier locomotives that had been introduced could not be carried safely by the bridge alone. Recently, as described in this article, the structure was strengthened, partly by the use of heavier welded eye-bars taken from two retired bridges, and was returned to full service

RECENTLY a 57-year old deck-truss bridge span on the Georgia Railroad, which had been supported on a pile trestle for the last 25 years because it was not considered capable unaided of carrying the larger engines that had come into vogue, was rehabilitated and strengthened and returned to service without its pile-trestle support. Of particular interest in connection with this project is the fact that certain of the existing eye-bars in the trusses were replaced with heavier members that had been salvaged from a retired bridge, and had been spliced by arc-welding.

Erected in 1882

This span, which is 150 ft. long, was erected in 1882 at a point between Athens, Ga., and Union Point on what is now a branch line of the Georgia Railroad. It forms the main span in a bridge across the Oconee river and is flanked at both ends by timber pile-trestle approaches. It is a pin-connected deck-truss span of the Pratt type, and is of combination wood and iron construction. There are six panels in the structure, each of which is 25 ft. long and 25 ft. high.

Members of each truss that were constructed of timber included the top chords, the end posts and the three verticals nearest the center of the span. The bottom chords, the vertical at the first panel point at each end of the span and certain of the diagonals were of eye-bars, while the diagonals in the two center panels of each truss were built-up lattice members. The floor beams were located at the panel points and midway of each of the panels, and to help carry the reaction from those at the latter points, a secondary timber post was provided in the center of each panel. Each of these posts was 7 ft. long and was supported by eye-bar members extending from its lower end to the tops of the adjacent verticals. In the bottom lateral system the diagonals consisted of eye-bars, while the transverse members at the panel points were of timber. The diagonal members in the top lateral system were of wood, while the transverse members at the panel points consisted of eye-bars. The floor beams, the stringers and the sway bracing were all of timber construction.

This span remained in active service and in good condition for many years, but by 1914 increases in the weight of locomotives had been such as to raise the question whether the structure was being over-stressed under the heavier loads. As a safety measure, therefore, a timber trestle was driven in the river in such a manner as to take the live load on the bridge directly at the top chords, with the result that, although the truss span remained in position and intact, it is doubtful whether it continued to carry more than a small part of the live load.

In recent years the cost of maintaining the trestle had become excessive and it became necessary to give consideration to the question of renewing it or of strengthening the truss span so that it could be restored to service. Accordingly, a careful in-

vestigation was made of the bridge and of the stresses that would prevail under the maximum present-day loading that could be expected. This investigation revealed that, with the exception of the floor beams and the secondary struts, the timber members were generally adequate. However, it was found that most of the iron members would be over-stressed and that, in order to return the bridge to service, it would be necessary to strengthen these members.

Heavier Eye-Bars Available

In its study of this subject the railroad took cognizance of the fact that it had available, from two retired bridge spans, a supply of eye-bars of the required sections that could be used in the strengthening work. When the two bridges had been retired some years ago, their scrap value was small and it was decided to hold the material for better prices. As time went by different parts of the old spans were salvaged and used for various purposes until eventually all of the members had been used except the eye-bars, which had no apparent value except as scrap. With certain alterations, as explained later, these eye-bars could be inserted in the Oconee River bridge to replace existing members that were considered of inadequate section.

Taking into consideration the fact that eye-bars for strengthening the bridge were already available and the further fact that the existing trestle would serve as falsework, thereby eliminating a substantial factor of cost, it was estimated that the old truss span could be strengthened at a cost of about $6,350. Although this was somewhat higher than the cost of renewing the trestle, which would run about $6,168, it was reasoned that the higher initial expense of strengthening the structure would be offset by the decreased cost of maintenance and the elimination of the hazard, always present during high water, created by the lodging of drift wood against the trestle. Hence, it was decided to proceed with the strengthening of the truss span.

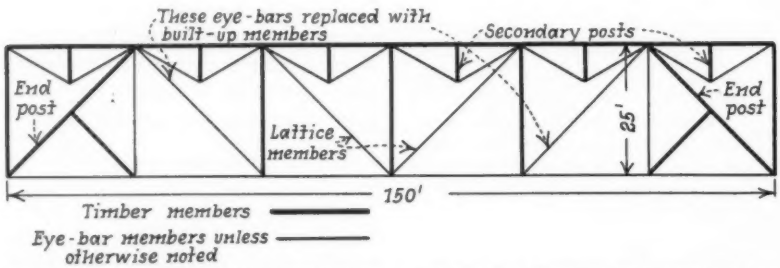
Method of Strengthening

Briefly, the strengthening program involved the substitution of heavier eye-bars for those in the bottom chords, in the vertical at the first panel point at each end of the span and in the supporting members for the secondary posts at the mid-points of the panels; the strengthening of the two lattice diagonals in each truss; the replacement of the eye-bar diagonal in the second panel from each end with a built-up member; and the renewal of some of the timber members, such as the floor beams and stringers, the secondary and end posts, the sway bracing, certain pieces in the top lateral system, and some of the top chord members.

More specifically, in regard to the bottom cords, the four existing 1-in. by 4-in. bars in each end panel were replaced with two 1⅛-in. by 5-in. bars and two 1 1/16-in. by 5-in. bars, and the four 1-in. by 4-in. bars in the second panel from each end were replaced with four 1¼-in. by 4-in. bars. Also the four ¾-in. by 4-in. bars and the two ⅞-in. by 4-in. bars comprising the bottom chord in the third panel from each end were replaced by two 1⅝-in. by 5-in. bars and two 1⅜-in. by 4½-in. bars. The two 1⅛-in. round bars forming the vertical at the first panel point at each end of the bridge were replaced with two ¾-in. by 4-in. bars.

Originally, one of the members supporting each of the secondary struts consisted of two ½-in. by 3½-in. bars, while the other was comprised of a single 1-in. by 3½-in. bar. In the strengthening program the double member at each secondary strut was replaced with a 1-in. by 3½-in. bar and a ½-in. by 3½-in. bar, while the single member was replaced with a 1-in. by 4-in. bar. Material for the 1-in. by 4-in. bars was salvaged from the lower chord members in the bridge, while all the other bars used in the strengthening work were obtained from the two retired bridges mentioned previously.

The built-up member that was installed to replace the diagonal in the second panel from each end of the trusses consists of two 6-in. by 4-in. by ½-in. angles, fitted with the necessary plates at the ends for the pin connections, the latter plates being riveted to the angles. The only change that was made in the lattice diagonals in each truss was to replace the existing end plates for the pin connections with heavier members.



Elevation of the Oconee River Deck Trusses. All Eye-Bar Members Were Replaced in Kind With Heavier Sections, Except Those in the Second Panel from Each End, Which Were Replaced With Built-Up Members. The Lattice Members Were Strengthened.

Eye-Bars Welded

The eye-bars taken from the retired bridges were not of the proper length for installation in the Oconee bridge and it was necessary to alter their length by cutting and splicing them. All splices were made in the form of double-V butt welds by the arc-welding process, this work being done in the shop under such conditions as to insure that welds of the best possible quality would be obtained. In this connection it should be noted that in all cases the conditions required the shortening of the bars, a fortunate fact in that only one weld was necessary in each bar. Obviously, the lengthening of the bars would have required that two butt-welds be made in each member.

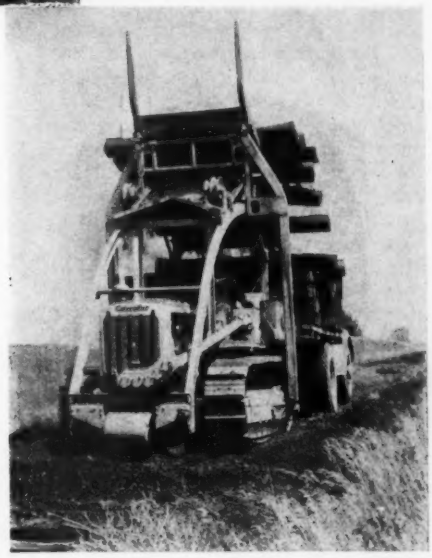
A complication was introduced by the fact that, whereas each of the bars inserted in the bridge had a 4½-in. hole in one end and a 4-in. hole in the other, all existing pins in the structure were 4-in. in diameter. Hence it was necessary to replace all the pins at the bottom panel points with 4½-in. members and to ream out the existing supporting castings to permit the larger pins to be installed. Moreover, where the new bars were installed as bottom chord members it was necessary to ream out the smaller hole in each bar to adapt it to the 4½-in. pins.

During the work of inserting the new members, considerable difficulty was experienced in removing the old pins from the castings. Since excessive hammering on the pins might crack the castings, care was taken to prevent such damage. In many instances it was necessary to burn out sections of the old pins and the adjacent bridge members to permit the removal of the casting so that the pins could be bored out in the shop. When dismantling the structure it was found that many of the lighter castings were broken, and these were replaced with steel plates, welded together to conform to the original castings.

(Continued on page 347)

In the removal of part of its Clinton Branch, the Chicago, Rock Island and Pacific used an Athey Mobiloader for salvaging and loading crossties. The use of this machine greatly speeded up the work and lowered the cost of track removal. All material, except crossties, was removed as the track was dismantled

Uses Novel Machine in Removal of Line in Iowa



Above — The Athey Mobiloader Scooping Up Crossties. Note the Ties Which Are Not to Be Salvaged Have Been Previously Pulled Out of the Track. Right — Mobiloader in Dumping Position

WHEN the Rock Island removed 50.09 miles of its line between Clinton, Iowa, and Bennett, the organization and methods employed for the track removal were based on the use of a crawler tractor equipped with an Athey Mobiloader for picking up and loading crossties, after the rest of the track, bridge and other salvagable materials had been removed. The use of the Mobiloader saved considerable expense in removing the crossties, and also greatly speeded up the other track removal work, since it was not necessary to load the crossties as the rail removal work progressed.

An adaptation of the Athey Mobiloader was used in which a two-pronged wedge-shaped fork was mounted on an inclined lift frame on the front end of a Caterpillar wide-gage D-4 Diesel tractor, in place of the usual earth-moving bucket. The fork, instead of lifting vertically, travels back over the top of the tractor. In operation, the Mobiloader scooped up six to ten crossties, which were then lifted up over the tractor to an apron on top, from which they rolled back onto a truck behind. The trucks were attached to the tractor by a cable. The loaded trucks carried the ties to the nearest siding where they were loaded in gondolas. As soon as one truck was loaded, another was coupled onto the tractor. In this manner, using enough trucks to keep the Mobiloader busy, the crossties on a mile of track could be loaded daily. The removal of the ties in this fashion was contracted, while the remainder of the line, with the exception of some of the larger bridges, was removed by company forces, using an American Eagle crane, a steam derrick and a work train.

Organization

The organization consisted of one assistant roadmaster, one extra gang foreman, one Eagle machine operator, one steam derrick engineer, one steam derrick fireman, 30 extra gang laborers, and one assigned work train and train crew. All material, except crossties, but including bridge material and some culvert pipe, was removed and loaded as the dismantling of the track itself progressed.

In removing the Clinton Line, the first operation was to pull all good telegraph poles and load them, together with any other salvagable material that could be picked up quickly and easily, such as end sections of cast iron and concrete pipes, signs, etc. At the same time, the portion of the extra gang not engaged in this work was employed in track thinning operations, preparatory to the rail removal. The telegraph poles were pulled by the American Eagle crane equipped with a chain and hook and were loaded into flat-bottom coal cars. One man on the ground hooked the chain around the poles and two men in the car placed the poles and unhooked the chain. In this operation the machine was rarely stopped unless the poles were difficult to pull. Prior to the pulling and loading operation, the ground around the poles was dug out a little on the track side. The end sections of pipe culverts and

other salvagable material were loaded by the steam derrick while the American Eagle crane was pulling the telegraph poles.

In the track thinning operations, two bolts on each joint were burnt off with acetylene torches and the nuts on the remaining two bolts in each joint were split. The spikes were pulled on all ties except every sixth tie on straight track and every fourth tie on curves of two degrees or more. These spikes were piled at the joints, and were loaded later, along with the angle bars and tie plates, when the rail was removed.

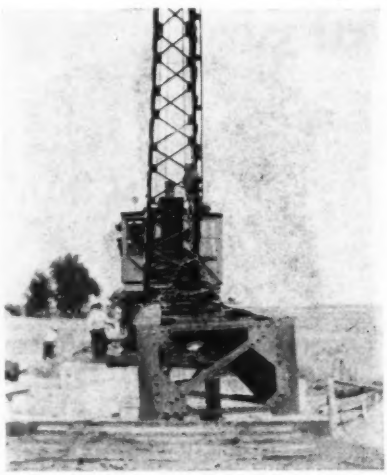
Track Removal

In the removal of the rail and fastenings, the American Eagle crane and flat cars were used. The crane backed up a rail length at a time, picked up two rails, one at a time, and swung them around to the car, on which they were loaded. While the second rail was being loaded, the crane made each back-up movement. In this loading operation, a control rope with a hook on one end was attached to one end of the rail. The rope extended through a pulley on the crane and was controlled by a man on the machine. This enabled the machine operator to swing the boom much more rapidly and speeded up loading operations. On the rail-loading work, a 40-ft. boom at the proper angle was found to be the best length to facilitate handling the rails quickly and to increase the production of the machine. The spikes left in the track after the thinning operations were removed only as the rail loading progressed, which enabled the work train to approach closely to the rail removal work at all times and speeded up switching operations.

The force used for actual rail removal consisted of the Eagle Machine operator and 10 to 11 laborers. Their operations were as follows: One laborer with a scoop shovel picked up spikes and other material piled at joints during the thinning operations. Two laborers pulled the remaining spikes, except the joint spikes, and another laborer pulled the joint spikes, loosened the joint bars with a 12-lb. sledge, and hooked the control rope through a bolt hole. One laborer hooked the rail tongs on the rail, piled the fastenings and spikes to be loaded and marked the ties to be salvaged. As previously mentioned, one laborer on the machine handled the control rope attached to the end of the rail. Two men on the flat car placed the rail and balled it in, one of these men also tabulated the lengths of the rails loaded and the other assisted in placing the salvaged spikes, fastenings, etc., on one end of the car. Two or three laborers, depending on the number of tie plates, picked up the fastenings and the tie plates and loaded them on the end of the rail car. Most of the rail removed was 50-lb., although some of it weighed 60 lb. per yard.

During the rail loading, culvert pipe were frequently picked up from under the center of the roadbed. These pipe were loaded on the rail car and were rolled back and forth from side to side out of the way of the rail loading. They were later loaded into gondolas at the switching point.

After the rail was loaded, those crossties which had less than four years of remaining service life, were pulled off on the edge of the embankment and the remainder were picked up and trucked in as previously described. At the loading point the ties loaded in each car were checked. Thirty-seven per cent of the track ties in the main track were salvaged.



A Steam Derrick Removing a 35-Ft. Deck Plate Girder Span Intact

Bridge Work

The steel work on the large bridges, including bridge No. 312 over the Cedar river and bridge No. 773 over the Wapsipinicon river, was removed by contract. The smaller spans and the trestles were dismantled and loaded by company forces. The Cedar River bridge consisted of a 24-panel pile trestle, two 104-ft. through plate girder spans, two 157-ft. through lattice truss spans and a 14-panel pile trestle. The girders were salvaged and the lattice trusses were scrapped. The contractor drove falsework, cut loose the girders and loaded them onto flat cars by means of gin poles and a winch. The lattice trusses were cut down with oxyacetylene torches into sections that would fit into a gondola and these pieces were loaded by an off-track crawler crane. The Wapsipinicon River bridge was removed in the same manner as the lattice truss spans of the Cedar River bridge. The contractor also removed and loaded two 65-ft. through plate girder spans and one 71-ft. deck plate girder span. All other bridges were loaded and removed by company forces and machinery.

The bridges removed by company forces were dismantled as the line removal progressed. The hardware on the pile trestles was removed in advance, leaving only enough to keep the bridges safe for slow train movements. The American Eagle crane or the steam derrick, depending upon the load, lifted and loaded the short girder and I-beam spans intact. On long pile trestle bridges, both machines were used, with the American Eagle doing the actual dismantling and the steam derrick behind taking ties and other material which could not be loaded on a flat car from the Eagle crane and loading this material in gondolas. This method greatly speeded up the work since, when the trestles were completely dismantled, they were also completely loaded.

The buildings at the stations on this line were usually sold to local farmers or townspeople. At paved highway crossings the rails were left in place until the highway department was ready to pave the gap, at which time they were removed.

In the removal of the Clinton line, 50.09 miles of main track, 3.07 miles of side tracks, 24 turnouts, 27 individual trestle bridges with a total of 175 panels, and 21 steel bridges with 33 spans were removed. In addition 724 lin. ft. of culvert pipe were recovered. The two outstanding features which helped speed up this work were the use of the Athey Mobiloader to load the ties separately, and the planning and methods used in the bridge removal work to minimize delays to the other work.

The removal of the Clinton line was done under the general supervision of W. H. Hillis, assistant chief operating officer, Chicago; H. T. Livingston, engineer of bridges, Chicago; and W. E. Weimerdinger, now division superintendent at Ft. Worth, Tex., who at that time was district engineer at Des Moines, Iowa. D. F. Kane was assistant roadmaster in charge and V. H. Carroll, contractor, Winthrop, Iowa, removed the crossties under contract.

(Continued from page 344)

Originally the secondary posts were each comprised of two 6-in. by 6-in. sticks, but in the strengthening work these were replaced by two 8-in. by 8-in. pieces. Although the existing timber end posts in the structure were of sufficient strength to carry the loads that would be imposed, it was decided, in view of the great length of time that they had been in service, to replace them while the strengthening work was under way rather than at some future time when the work would be much more costly. Also, all the timber laterals and the sway bracing were replaced with heavier material to insure that the structure would have ample strength against sidesway. Before any work was undertaken on the bridge the camber was checked carefully, and material for the top chords that were to be replaced was framed to conform to the amount of camber required.

Formerly, each of the floor beams in the bridge consisted of two 7-in. by 14-in. timbers, but in the strengthening work each of these members was replaced with three timbers of the same size. Likewise, the four 7-in. by 14-in. timbers, arranged in pairs, that formerly comprised the stringers, were replaced by six timbers of similar size, which were arranged in two groups of three each.

As a result of the reconstruction work described above, the total dead load of the bridge was increased about 34 per cent, while the strength was increased 27 per cent. The project was carried out under the general direction of S. R. Young, chief engineer of the Georgia Railroad, and under the direct supervision of C. E. Jacobson, assistant engineer. We are indebted to Mr. Jacobson for the information contained in this article.

Tarvialithic Platforms With Scrap Rail Curbs

RECENTLY (before Pearl Harbor), the Illinois Central replaced several of its plank track platforms at its Central station in Chicago with Tarvialithic platforms. These platforms were installed with scrap rail curbs of several types and are expected to stand up under the heavy trucking and foot traffic with less maintenance expense than the wood platforms. The rail curbs are made of scrap 85 or 90-lb. rail and are supported in an ingenious manner on scrap rail posts, which are about 4 ft. long and are spaced about 6 ft. apart. These posts are placed about 3 ft. in the ground, with the base facing the adjoining track. The upper ends of the posts were cut by acetylene welding torches to fit the scrap rail curb placed upon them and to prevent it from turning. Two types of rail curbs were installed, one type with the rail mounted ball up, or workwise, and the other type with the rail turned on its side, with the base forming the edge of the platform.

For the first type of rail curb, with the ball up, slots about 1 in. wide and 5 in. deep were cut in the web at the upper end of the rail posts. Notches were also cut in the base of the curb rail on both sides at the locations where the rails fit on the posts so that when the curb rail was set in place it fit in the slots cut in the rail posts. The arrangement supported the curb rail firmly and prevented it from tipping. The curb rails were connected with scrap angle bars, using two bolts in each joint.

On the other type of curb, with the curb rail resting on its side, the tops of the posts were cut with a welding torch to a contour to fit the side of the curb rail, with the exception that a portion of the web, about 1½ in. wide and 4 in. long, was left protruding to form a tongue projecting above the end of the post. Holes were cut in the web of the curb rail at proper intervals for the tongue to project through and when the curb rail was laid in place, the tongue was heated with torches and bent over, clinching the rail firmly in place. In these curbs, the joints were spot-welded from the top side one-half way through to form a continuous curb.

Installation

In installing these platforms, the old wood walks and platforms were first torn out and holes for the rail posts were dug with post hole diggers. The rail posts were placed and the level of their tops was checked, as compared to the level of the track rails, after which the posts were tamped solidly and the curb rails were installed. The bed of the platform was then filled with mine run gravel to fill in any holes and bring the grade-line up to a proper level. On this, four inches of a mixture of 1½-in. crushed rock and screenings was spread uniformly and then rolled with a 5-ton gasoline pavement roller. Following the placing and rolling of the stone, a 3-in. course of Tarvialithic, which was premixed with ½ in. stone and delivered hot, was spread and compacted by the roller. This Tarvialithic compacted to a thickness of about 2 in. under the roller. A final layer of 1½ in. of fine premixed Tarvialithic, which contained ¼-in. chipped stone, was then spread and rolled and this layer compacted to a thickness of approximately 1 in. The total thickness of the platform, including crushed rock and Tarvialithic, when completed, was about 6½ in. The platforms were crowned from ½ in. to 1 in. in the center, depending upon their width, to provide drainage.

Some of the new platforms were raised considerably as compared to the old plank platforms and in such cases new 2-in. by 12-in. creosoted planks were cut to fit between the rail posts and were placed before the rail curb was installed. The ball and web of the rail posts formed a chase which held the planks securely in place. On other platforms, which were not as high, planks of lesser width, as required, were cut and placed between the rail posts under the curb rail.

Several platforms of another type with rail curbs were installed at the Central station, and also on intertrack platforms at a number of other points elsewhere on the system. This type of platform is used between tracks of the same elevation and con-

The 5-Ton Gasoline Pavement Roller Completing the Surface on a Platform. Note the Neat Appearance of the Rail Curb

sists of two scrap curb rails spiked to new cross or switch ties, depending upon the length required, which are placed between the tracks at intervals of every fourth or fifth track tie, with their ends interlaced with the ends of the track ties. The platform ties are tamped to the elevation required to bring the curb rails level with the top of the track rails; the curb rails are then connected with scrap angle bars, using two bolts per joint, and are spiked to the platform ties. This type of platform is usually filled with a mixture of stone and screenings and tamped or rolled, without any other top surfacing material. In the Central station, however, stone and Tarvialithic were placed as previously described.

The Illinois Central has been well pleased with the service received to date from its new platforms. They stand up well under heavy trucking and the rail curbs maintain good line. Before the present-day shortage of scrap developed, the cost of installing these types of platforms was well below that of new plank platforms. In addition, they are expected to last almost indefinitely with much less maintenance than is required for plank platforms under similar service conditions.

Recent Rail Breaks Cause Five Derailments

ACCIDENT reports issued by the Interstate Commerce Commission since the first of the present year cover five serious train derailments due to broken rails, two on the Florida East Coast, and one each on the Michigan Central, the Atlantic Coast Line and the Illinois Central, these accidents resulting in the death of six passengers and employees and the injury of 228 others. Three of the accidents were caused by transverse fissures, while the other two were caused by what appeared to the Commission to be progressive fractures in the rail webs, which broke through the head and base under traffic.

On the Illinois Central

The accident on the Illinois Central, which occurred on November 23, 1941, was in single-track territory on the Birmingham district, 1.69 miles south of Corinth, Miss. The train involved was a first-class passenger train, northbound, which consisted of a steam locomotive, one mail car, one express car, one baggage car, three coaches, two dining cars, three Pullman sleeping cars and one Pullman sleeping-observation car, in the order named. This train, according to testimony at the Commission's investigation, was derailed about 4:54 p.m. while moving at a speed estimated between 55 and 70 m.p.h. The maximum authorized speed in the territory involved is 70 m.p.h. In the accident, all of the equipment back of the first three cars was derailed and considerably damaged, one of the cars being destroyed by fire, resulting in the death of three passengers and the injury of 112 others, including the conductor.

The point of the accident was on tangent track laid with 90-lb. rail, 33 ft. in length, on an average of 20 ties to the rail length. The track was fully tie-plated, single-spiked, equipped with six anti-creepers to the rail length, and ballasted with 12 to 14 in. of slag on top of 4 in. of gravel. Contributing to the seriousness of the accident, in all probability, was the fact that the track at the point of derailment is on a fill with a maximum height of 28 ft.

Soon after the accident occurred, according to the report of the Commission, a rail on the east side of the track was found broken into numerous pieces, 34 of which were recovered, constituting about 29 ft. of the 33-ft. rail section. The first break occurred between two ties at a point 25¼ in. north of the receiving end of the rail, the 25¼-in. piece remaining in its normal location. At this break, a transverse fissure covering about 75 per cent of the cross-sectional area of the head was found, and wheel marks indicated that the derailment occurred at this point. Four other transverse fissures, each of which covered about 10 per cent of the cross-sectional area of the head, were found in the broken rail. All breaks, according to the report, except the first, appear to have occurred during the derailment.

According to testimony of the Commission's investigation, the track at the point of accident had been inspected twice on the day prior to the accident by the local section gang, and no defective condition was found. The large fissure at the first break had not progressed to the surface of the rail head at any point, and prior to the accident could not have been detected by visual inspection. A detector car was last operated over the track involved on February 7, 1941, at which time four defective rails were found, none of which, however, were within a mile from the point where the accident occurred.

On the Atlantic Coast Line

The accident on the Atlantic Coast Line occurred on the Waycross district of the road, in single-track territory, at a point 7,468 ft. south of the station at Hortense, Ga. The train involved, which was moving southbound at a speed of 78 m.p.h.—2 m.p.h. under the maximum authorized speed for the train—was a first-class passenger train consisting of a 2-unit Diesel-electric locomotive, three express cars, one baggage-mail car, one dormitory car, four coaches, one dining car, one tavern car and three Pullman sleeping cars. This train was derailed at 4:30 a.m. on November 27, 1941, the eighth to the fourteenth cars, inclusive, leaving the track and turning over at various angles, causing the death of two passengers and the injury of 75 passengers and two employees.

The accident occurred on tangent track at a point 326 ft. beyond a relatively short 1-deg. 47-min. curve, the only curve in a stretch of about 42 miles. In the vicinity of the accident, the track is laid on a fill about 10 ft. high and consists of 100-lb. rail in 39-ft. lengths, on 24 treated ties to the rail length. It is fully tie-plated and single-spiked, and is equipped with 4-hole continuous angle bars and four anti-creepers the rail length. The track is ballasted with 10 in. of slag on top of 6 in. of gravel.

Soon after the derailment occurred, a broken rail with four transverse fissures was found on the east side of the track, the rail having been broken into at least 15 pieces. The first fissure was 4 ft. 3 in. from the receiving end of the rail and covered about 75 per cent of the cross-sectional area of the head, but had not progressed to the outer surface at any point. The second fissure was located 9 ft. 7¾ in. from the receiving end of the rail and covered about 50 per cent of the head area, while the third and fourth fissures were, respectively, 21 ft. 6¼ in. and 24 ft. 7 in. from the receiving end and covered, respectively, 6 per cent and 15 per cent of the head area.

According to the Commission, the other breaks in the rail appear to have resulted during the process of the derailment. Apparently, it pointed out, the derailment occurred at the first fissure and the rail did not become broken until after the front part of the train had passed over it.

The track involved was inspected from a motor car five days before the day of the accident and no defective condition was found. A detector car was last operated over this district on January 23, 1940. Other facts in the Commission's report brought out that during the two months prior to the accident in question, two other broken rails had been found in this same general territory; also, that the Commission had investigated the derailment of a passenger train, as the result of a rail that had broken on March 30, 1941, at a point 5.5 miles north of the point where the accident here under consideration occurred. As a result of its findings, the Commission stated that there was need for more frequent and thorough inspection of the track on this line.

On the Michigan Central

The accident on the Michigan Central occurred on January 13, in single-track territory on the Michigan division of the road at a point 1.96 miles south of the station at Mullet Lake, Mich. The train involved was a first-class passenger train, consisting of a steam locomotive, three baggage cars, one railway postal car, one passenger-baggage car, one coach and one Pullman sleeping car. This train, which was moving northward at a speed of 35 m.p.h., was derailed at about 7:30 a.m., with material damage to the equipment and the death of one employee.

The point of accident was on tangent track, about 395 ft. beyond a 1-deg. curve, laid in 1925 with 90-lb. re-rolled rail in 33-ft. lengths, on an average of 20 treated hardwood ties to the rail length, the rail being single-spiked, without tie plates, and equipped with 4-hole angle bars, 25 in. long. The track is ballasted with gravel and cinders to a depth of 15 in. below the tops of the ties.

After the accident, according to the report of the commission, several broken rails were found in each side of the track. Of the first broken rail on the east side, a piece of the receiving end, 13 ft. long, remained in normal position. The remaining portion of this rail was broken into many pieces, some of which were not recovered.

Among the pieces recovered was a section of web and base 18 in. long. The surface of the broken web was considerably discolored by oxidation, which indicated that the fracture had existed for some time prior to the derailment. The other rail fractures appeared to have resulted during the derailment, so it was concluded that the initial failure occurred at the point where the old fracture existed, and that probably the head and upper part of the web of the 18-in. section were broken by the last train prior to the one which was derailed.

Testimony during the commission's investigation brought out that the section foreman on the territory involved had inspected the track from a passenger train about 24 hours prior to the accident, but that he did not observe any abnormal condition of the track at that time. It also brought out that a detector car was last operated over the track involved in September, 1934.

On the Florida East Coast

The more or less similar type of rail break on the Florida East Coast, but involving the injury of 29 passengers, occurred on January 11 in double-track territory on the southward main track of the road at a point 3.78 miles south of Sampson, Fla. The train involved, which included a three-unit Diesel-electric locomotive, 1 baggage car, 10 Pullman sleeping cars, 1 Pullman lounge car, 2 dining cars, 1 Pullman recreation car and 1 Pullman observation car, was, according to testimony, traveling at a speed of 80 m.p.h., the maximum authorized speed for the train in question at the point involved. In the accident, the rear truck of the last Diesel unit and 11 cars were derailed.

The accident occurred on a 1-deg. 4-min. curve, in track consisting of 90-lb. rail in 39-ft. lengths, rolled in March, 1925, and laid during the same year on 22 ties to the rail length. The track is fully tie-plated, single-spiked, equipped with 24-in. 4-hole, 100-per cent angle bars, with eight anti-creepers to each rail, and is ballasted with slag and rock to a depth of 13 in. The maximum superelevation in the curve involved is 2¼ in.

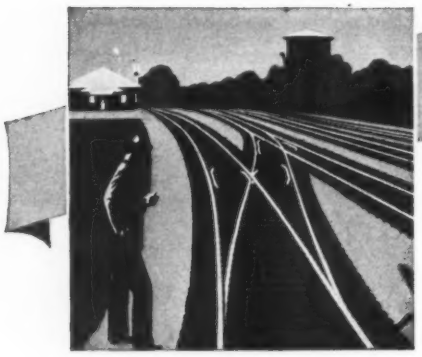
According to the commission's report, the fracture causing the derailment occurred 11½ in. north of the leaving end of the specific rail involved. This fracture was at a 45-deg. angle through the second bolt hole in the joint, extending upward through the head and downward through the base. A second piece of the rail, which apparently was broken during the derailment, was triangular in shape, being formed from a second break through the second bolt hole extending downward through the base.

Examination of the first mentioned break showed that a progressive fracture extended from the bolt hole upward to the bottom of the head of the rail, as evidenced by the presence of oxidation of this part of the fracture. The fractures through the base and the head of the rail were new. Nothing is stated in the report relative to the last inspection of the track involved by the section forces, but it is pointed out that a detector car was last operated over the track on December 22, 1941.

The second derailment caused by a broken rail on the Florida East Coast on January 11 occurred in double-track territory on the northward main track at a point 1.74 miles south of the station at Bayard, Fla., and involved a first-class passenger train consisting of a Diesel-electric locomotive, one passenger-baggage car, four coaches, one diner and one lounge car, all of streamlined, lightweight, all-steel construction. This train, which, according to testimony taken by the commission, was being operated at a speed of 82 m.p.h., 3 m.p.h. below the maximum allowable speed for the train and territory involved, was derailed at 12:20 a.m. on January 11, the last two cars leaving the track and causing the injury of nine passengers.

The accident occurred on tangent track of practically identical construction with that involved in the other derailment on the same road on the same day—that is, with 90-lb. rail laid new in 1925, on 22 ties to the rail length. After the accident, a badly shattered rail was found on the west side of the track, as many as 17 pieces being recovered. The first break occurred between two ties at a point 10 ft. 2½ in. north of the receiving end of the rail. At this break there was a transverse fissure covering about 25 percent of the cross-sectional area of the rail head. At the second and third breaks, which occurred at points 14 ft. 7 in. and 18 ft. 3½ in. north of the receiving end of the rail, transverse fissures were found covering, respectively, 20 per cent and 10 per cent of the cross-sectional area of the head. None of these fissures had progressed to the outer surface of the head. Wheel marks on the rail at the south end of the third broken section indicated that the derailment occurred at this point. The other breaks in the rail appeared to have resulted during the derailment.

According to the report of the commission, the track at the point of accident was inspected by the section foreman on the day prior to the accident and no defective condition was found. Also, a detector car was last operated over the track involved on December 3, 1940.



WHAT'S the Answer?

Slow Orders on New Rail

Where traffic is diverted around a rail gang on multiple track, is it desirable to place a slow order on the new rail when traffic is resumed? Why? What should be the speed limit? How long should the restriction remain?

Slow Order Necessary

By C. B. Bronson
Inspecting Engineer, New York Central, New York

This question raises a pertinent issue because of pressure from the operating department to minimize delays to traffic. Every minute counts in maintaining the tight schedules that are now generally in effect, for which reason the use of a track for unlimited periods during the day in multiple-track territory is more and more becoming a thing of the past. Diversion of traffic to adjacent or parallel tracks cannot be made without many and sometimes serious interruptions to set train schedules. Maintenance forces are, therefore, going back to laying rail under traffic.

However, the question pertains to cases where at least a part, if not all, of the traffic is diverted to adjacent tracks, in which event the rail gang has virtually unlimited use of the track until the day's work has been completed. In such cases, when the allotted time is up and the track has been full bolted, spiked, bonded, and anchored, with all other incidental work finished, and has been inspected carefully by the supervisor in charge, normal operating speed is permissible, although if a somewhat lower speed is deemed advisable, some restriction may be placed. For example, if the combined height of the new rail and tie plates is greater than that of the old rail on the opposite side, it may be necessary to limit the speed, but this restriction should be removed when the second line of new rail has been laid.

More important are the speeds of trains where the rail is being laid under traffic, and only part of the trains are being diverted. Here, some trains must pass over the rail during the progress of the work and temporary closures must be made; perhaps several during the day. Obviously, the supervisor will organize the work to lay the maximum amount of rail in the allotted time, including the secondary work necessary to make the track safe for operation. In this case, trains can be permitted to operate at 30 m.p.h. and this speed can be adhered to on the stretch of track on which the rail is being laid, until the end of the day, at which time the restriction may be lifted, unless the second string of rail has not been laid.

There are several reasons, beside that of playing safe, why a slow order is necessary under the foregoing conditions. In a large gang, some of the men may not be thoroughly versed or skilled in the details of the work. Also, a wide variety of power machines and tools, and many hand tools, are placed adjacent to the track during the passage of the train. Again, the possibility always exists that complete spiking and bolting may not have been finished in the allotted time. For these reasons it is decidedly in the interest of safety to have traffic move at reduced speed.

This is not intended to imply that every effort should not be made or

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in July

1. *What factors determine the necessity for renewing rail? What weight should be given to each? Are other considerations involved?*
2. *What precautions should be observed to reduce the fire hazard in creosoted pile and timber trestles?*
3. *Do double-shoulder tie plates prevent or retard the buckling of track? Why? To what extent? What other forces are operative?*
4. *What special precautions, if any are necessary when painting exterior wood surfaces during hot, dry weather?*
5. *Where track is surfaced out of face periodically, what method of maintenance between periodic surfacings will give best results? Why? Does the kind of ballast or the character of the traffic make any difference?*
6. *What are the advantages and disadvantages of coating the interior of steel water tanks? How can this be done? What kind of coating should be used? Why?*
7. *What are the advantages of oiling joint bars in the track? Are they sufficient to warrant the cost? How should the oil be applied? When?*
8. *In view of the restrictions placed on the use of steel and other metals, what substitute materials can be employed for sash in shop, office and other buildings? What precautions should be observed?*

precautions taken to finish all details of the track work ahead of permission for traffic to pass over the track. On the other hand, unavoidable delays may not allow sufficient time for all of the details to be fully completed ahead of the arrival of any train that is permitted to use the track. As pointed out, at the end of the day's work the newly laid rail is inspected carefully from one end of the job to the other to insure that all of the multitudinous details have been attended to and that necessary minor adjustments are made.

Take All Precautions

By C. E. Miller
Assistant Engineer Maintenance, Chicago & North Western, Chicago

When new rail is laid, the purpose is to secure the best track conditions and the longest possible life of the rail, with the minimum future maintenance expense. To accomplish this, every precaution should be taken to avoid damaging the new rail, which is the most expensive item in the track structure. If the new rail is opened to traffic before it has become seated and supported properly, it is quite sure to be overstressed or distorted in varying degree, resulting in light surface and line bending. It is evident, therefore, that the speed should be such, at first, to insure that the rail will not be damaged before it is protected properly.

Tie plates having any design of ribbed bottom will require the passage of a considerable amount of traffic before they become seated firmly, and if normal speeds are permitted before the plates have become sufficiently anchored to the ties, there will be movement that will result in irregularities of line and gage, causing lateral thrusts on the rail by reason of the nosing of locomotives, which may cause slight line bends if the operation is long continued. This movement and unequal settlement of the tie plates also make necessary an excessive amount of regaging at additional expense as well as damage to the ties.

It is quite difficult to move tie plates the small amount that is necessary in regaging after the bottom ribs have taken their initial settlement into the tie, for which reason it is desirable to avoid their lateral movement as much as possible. This can be most nearly accomplished by restricting train speeds immediately following the laying of the rail. Some good results have been obtained by arranging for the work train to make a trip or two over newly-laid rail at a speed of five to ten miles an hour before the track is opened to regular traffic, as this slow speed will give the plates their initial set at the proper place.

Again, rail that is removed, generally has some rails that are surface bent or that have low joints, with the ties surfaced to conform to this profile. When the new rail is laid, it will then be unsupported at the points that were low in the original rail. If the new rail is opened immediately to fast traffic, it will receive severe punishment and probably will be bent permanently at these unsupported points.

It is not uncommon to restrict tie renewals to the minimum where it is known that rail will be renewed the following year, with the idea that heavy renewals will be made when the new rail is being surfaced. This means that tie conditions are somewhat below standard at the time the rail is laid and will continue to be until renewals are made. Likewise the support for the rail will be below par unless improved through renewals, surfacing or shimming, and until this is done the speed should be restricted.

What the speed limit should be involves several factors and can best be determined by the local officers after giving consideration to tie conditions, the surface and gage of the old track, and the weight and load distribution of the locomotives, with some knowledge of their dynamic augment and other characteristics that may cause high rail stresses at high speed. As a general statement, however, I believe that where passenger speeds of 60 to 90 m.p.h. are permitted normally, restriction to 40 to 60 miles should be enforced.

While it is recognized fully that fast schedules are the order of the day and that they should not be interfered with unnecessarily, the protection of the investment in the new rail and its future life and maintenance are also of prime importance. These considerations are sufficient to offset the few minutes delay to trains during the short period required to put the track in shape to avoid rail damage, and they justify the placing of speed restrictions temporarily.

Emptying Heating Systems

Should hot water heating systems be emptied during the summer? Why?

Should Be Kept Filled

By G. A. Rodman
General Supervisor of Bridges and Buildings, New York, New Haven & Hartford, New Haven, Conn.

It is my experience that hot-water heating systems should be kept filled with water at all times to prevent excessive corrosion. If it becomes necessary to empty the system, it should be filled immediately with clean water. Some heating engineers recommend that the water be drawn off once each year and be replaced with clean water, but I do not consider that this is either necessary or desirable.

The Answer Is Yes

By L. L. Tallyn
Division Engineer, Delaware, Lackawanna & Western, Scranton, Pa.

The answer to this question is yes. The reason is that during the heating season there is a continuous circulation of water, which gathers up and deposits the black sediment that usually settles in low spots, and which, if left undisturbed long enough, will become a thick putty-like mass. Depending on the construction of the boiler, if this mass becomes heavy enough, it may cause the iron to burn and crack the boiler. After the system has been drained and cleaned, it should be filled promptly to prevent the air from causing corrosion in the interior of the system.

Would Empty Them

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

We consider it important to empty all hot-water heating equipment as soon as it is no longer required in the spring. At this time we wash out the pipe lines and boiler thoroughly and remove the valves, making any repairs or replacements that are necessary to place them in good condition, and then lubricate them lightly. Check valves and gages should be checked and replaced for immediate use when required. Where water is allowed to collect or remain in boilers and pipe lines or where moisture is permitted to accumulate, it usually sets up corrosion or in-

creases the scaling of the boiler and damages pipe lines and valves.

It is our practice to make an immediate inspection of all heating equipment as soon as the weather permits its operation to be discontinued, to determine its general condition and to place it in order for use the next season. Where this is done, delays in heating buildings are avoided during the first cold days of autumn. On the other hand, in many cases, heating is delayed and causes inconvenience or discomfort to persons working in the building if the equipment is not ready for service when needed. Furthermore, this practice also eliminates damage to the equipment, which sometimes occurs when inexperienced employees are allowed to build fires under boilers, the maintenance of which has not yet been taken care of.

Empty, But Fill Again

By Superintendent of Buildings

The ideal situation with respect to a hot-water heating plant is to employ a soft water that will neither scale nor sludge, and to have an open expansion tank at the high point of the system that is kept filled to the correct operating height automatically by means of a float valve. This arrangement will insure that all air will be expelled from the heating water. In this event, it will be unnecessary to empty the system, except to make repairs or replacements that cannot be made while it is filled.

Unfortunately, this ideal situation is rarely found in the average railway installation. In fact, waters of varying degrees of hardness are employed to fill the systems and in some instances even waters having corrosive qualities have been used, while few of these systems are able to expel all of the entrained or dissolved air. For this reason, it becomes necessary at the end of the heating season to empty the system and to wash and clean it thoroughly. Valves and gages should be removed, cleaned and repaired, and any part of the system needing renewal, should be replaced. The system should then be filled with the best water obtainable, the boiler should be fired and the water circulated to bring any entrained or dissolved air to the high point of the system where it can be drawn off. After the air has been expelled, the plant should be shut down for the summer and not disturbed again until it is to be fired in the fall. Expelling the air from the water will prevent corrosion of the pipes and boiler.

Which Holds Gage Best?

Do independent fastenings in tie plates have greater or less gage-holding power than the rail spikes? Why? How much? Does the kind of fastening make any difference?

They Stop Gage Widening

By I. H. Schram
Engineer Maintenance of Way, Erie, Jersey City, N. J.

Independent fastenings in tie plates have been discussed in their several phases for many years, including phases other than the effectiveness of the independent fastening as a gage-holding device. These other elements have been mentioned in some other articles, one of which the writer was privileged to contribute to this department of the magazine a few months ago, but these other features need not be discussed here.

The portions of the track structure that resist widening of the gage include the tie plates, which resist this action if they have a bottom face designed for this purpose, in contact with the tie; the spikes, against which the outside edge of the rail base bears and the other spikes, which, however, must necessarily transmit their resistance through the tie plate; and the outer shoulder of the tie plate. When the tie plate is of sufficient size and cross section, and is otherwise designed properly, it will be effective. It will not be necessary to enter into a discussion of these features of the tie plates, for it can be assumed that they will be the same for all types of fastenings.

It is well known that on heavy-traffic curved track, two ordinary spikes are not sufficient to maintain gage. On much of this track, one or two additional gage spikes have been added to each tie plate and in some instances this also has been insufficient. However, where tie plates with independent fastenings have been applied, the widening of the gage has been stopped. This result can be attributed to several causes, as follows:

1. The effectiveness of the spike depends largely on its hold in the tie and the resistance of the surrounding fibres to the movement of the spike. The gage spike is loosened by the wave action of the rail, which decreases the effectiveness of the holding power between the spikes and the wood fibres, whereas there is no such disturbance of the fibres surrounding the independent fastening.

2. The gage spike is seldom driven to its full depth at all times as the wave motion in the rail pulls it up somewhat, thereby losing considerable of its bearing area; the independent fastenings are not affected in this way.

3. The gage spike is subject to necking (throat cutting), which decreases its cross-sectional area and its holding power, to a much greater extent than an independent fastening. The gage spike is withdrawn and redriven in plugged holes much oftener than the independent fastenings, which tends also to decrease its holding power. The effect of all this is quite difficult to determine, although we know from experience that the independent fastening is much more effective than the other, but the amount varies with so many factors, such as density and speed of traffic, size of the tie plates, weight of rail, etc., that it is difficult to calculate it.

The type of independent fastenings also makes considerable difference. After many years experience with lag screws, it seems that they are more effective than any other kind of fastening, because they hold the tie plate more securely, and with less motion in the track structure, than any other type. As has been stated, the lag screw and tie plate become practically an integral part of the tie with no relative movement between the tie and the tie plate. This eliminates the transverse motion which in effect multiplies into spread track.

Do a Better Job

By Track Supervisor

Independent fastenings in the tie plate hold gage (that is, they prevent lateral displacement of the rail) better than the rail-holding spikes. The principal reason why this is so is that these spikes have only one duty to perform—that of holding the tie plate in firm contact with the tie. They are thus able to prevent the plates from shifting and avoid abrasion of the wood, which in itself adds to the tendency of the plates to shift as force is applied laterally to the rail.

Rail spikes must perform two duties. Their function is to hold the rail

vertically as well as laterally but, under the wave motion of the rail, they are partially withdrawn from the wood. This tends to enlarge the spike hole, while the hole punched in the gage side of the plate is generally slightly larger than that for the anchor spike. Close observation will show that the rail spikes on the gage side tend to rise more often than those on the outside, while both show a more decided tendency to do so than independent fastenings or anchor spikes.

Being driven into smaller and tighter-fitting holes, anchor spikes allow much less plate movement, while there is co-ordination of effort between the inside and outside anchor spikes in resisting the tendency of the track to spread. The rail spikes are unable to do this, until one or the other of these spikes has moved laterally a sufficient distance so that both are bearing against the plate metal, because of the larger dimensions of the punching. In other words, either one spike or the tie plate, or both, must shift before the plate can have a bearing value on both spikes.

Again, anchor spikes are driven so that the head of the spike is in contact with the tie plate, while the rail spikes must bear in the same manner on the base of the rail, thus giving additional leverage on these spikes for the forces that tend to cause lateral displacement. Then, when the spikes are withdrawn for any reason, such as relaying rail, the hole is plugged and the spike is redriven. This tends to create further destruction of the wood fibre and decrease both the lateral and vertical holding power of the spikes. If the new rail has the same base, there is no necessity for pulling the anchor spikes, so that they retain their full power of resistance. My judgment, based on observation only, is that anchor spikes have at least double the resistance to lateral movement that the rail spikes have, when first installed, and that this ratio increases during the life of the ties.

I have only observation to guide me in answering the last part of the question. Crude tests with a track jack have indicated that square spikes driven into prebored holes have greater lateral resistance than round spikes. Furthermore, I believe that the common track spike has more chance of being kept driven down than a screw spike which requires an extra tool or extra effort to keep it in place. Observation of screw spikes after more than 15 years service indicated that it is impossible to tighten them because the heads are corroded and the threads are frozen in the wood to such an extent that breakage is high. If, as a last resort, it is attempted to drive them down with a maul, the wood fibres are damaged so badly that they will no longer stay down.

Installing Duplicate Equipment

Is it desirable to install duplicate pumping and power equipment at water stations? If not, why? If so, what are the advantages? The limitations?

Many Factors Involved

By J. H. Davidson
Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

When referring to duplicate equipment we usually mean two units of the same type and capacity, either one of which can supply the water at the station under consideration. While serving to protect the station in the same way as duplicate equipment, standby equipment may consist of a pumping unit of a different type and capacity from the principal unit and may or may not be operated by the same kind of power. Standby service may also be provided by a connection with a municipal or a privately-owned water supply, through which water may be obtained in case of an emergency.

There are many factors to be considered in deciding whether to install duplicate or standby pumping equipment at a given station. Among the most important of these are the ratio of storage available to daily consumption, the hours of pumping required daily and the availability of repair parts and of mechanics to make needed repairs quickly. A careful study of all of the local conditions affecting the reliability of the station must be made in every case.

At all large terminals, where any shortage of water would result in serious delay to traffic, duplicate pumping equipment is very desirable, unless a suitable arrangement can be made for a connection with a municipal or private water supply that can be used in an emergency. At smaller terminals, it will probably also be advisable to provide duplicate equipment or suitable standby service.

Many of the less important main and branch-line stations do not require duplicate or standby pumping units or power service. This will be governed largely by such factors as the spacing of adjacent water stations, the ratio of storage and the hours of pumping required daily. It often occurs that, in rebuilding a water station, some of the old pumping equipment can be left in place to serve for standby service.

Mentions Five Factors

By R. C. Bardwell
Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

The desirability of installing duplicate pumping and power equipment at a water station will depend upon a number of factors, such as (1) the importance of the station, (2) the available storage with reference to consumption, (3) reliability of the power, (4) type and condition of the equipment and (5) the availability of repairs. The function of a railway water station is to have water available for locomotive use at all times, as a shortage may result in delays to trains which might readily involve more expense than the cost for reliable power units and pumping equipment.

If a water station is of real importance and ordinary repairs cannot be completed in case of possible trouble before the available storage is exhausted, which might result in train delays, the installation of duplicate units is advisable. Similarly, if the power is not reliable, or if the type and condition of the equipment are not dependable, protection in the way of duplicate units is desirable to assure an uninterrupted supply. At small and unimportant stations having ample storage, reliable equipment and dependable power, the desirability of installing duplicate pumping and power equipment is questionable, since the maintenance expense will be increased by reason of the necessity for operating the standby units occasionally to insure immediate availability when they may be required.

Dependability Essential

By E. C. Johnston
Water Service Foreman, Baltimore & Ohio, Punxsutawney, Pa.

A dependable water supply is essential to the operation of trains. Water failures disrupt schedules at any time but are critical at times of peak business, and all reasonable means must be taken to avoid them. When locomotives and tenders were small and trains short and slow, water stations

were generally located at almost every conveniently available supply along the line. As a result if a locomotive ran short of water it could take water at the nearest tank with little, if any, delay.

Today, trains are long and schedules are fast; tender capacities range up to 25,000 gal. and water stations are farther apart, so that a water failure is almost unpardonable. To avoid failures, supplies must be adequate, or duplicate supplies provided. Where there is a dependable municipal system available, connections should be made for standby needs, thus avoiding the necessity for duplicate equipment. However, even this must be done with considerable caution, for domestic supplies may be affected by drought, the same as the railway supply. Often adequate roadside storage is the solution. If the supply is ample and sufficient storage can be built up in eight hours to care for consumption for 24 hours, duplicate units are not necessary.

Important water stations on busy lines must not fail. At such stations duplicate pumping and power equipment is an economical and satisfactory solution of one phase of the problem of dependability. In addition, where it is possible to do so it is desirable to provide storage for more than the 24-hour consumption. Further economy can be developed where it is possible to install identical pumps and power units in several water stations on a district or region. In this case, one or two duplicate units held at a central point will give much greater protection to all of the stations involved.

The water supply on any railway, and particularly on a busy line, is worthy of careful and painstaking study. It should be in charge of some one who is able to devote his entire time to work out the most dependable and most economical supply possible.

Jacking Pipe Culverts

What preparatory work is necessary for jacking pipe culverts through embankments? What equipment? How many men? Does the size of the pipe or the width of the embankment make any difference?

Do It in Dry Weather

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

The preparatory work preceding the jacking of pipe culverts depends in large measure on the height of the embankment, the kind of soil, weather conditions and whether water will need to be taken into account. When at all possible, the jacking of pipes through embankments should be done during the fall or dry season.

Where pipes 42 in. or more in diameter are to be jacked through embankments less than 8 ft. high, from the base of the rail, in good clay soil, it is advisable to place long supporting timbers under the rails to offset the vibration of the embankment directly over the pipe that is being installed. This also applies to almost any other kind of soil, but if the embankment is 12 ft. or more from the base of the rail to the bottom of the culvert, the supports for the rails become unnecessary.

For these reasons, where the general condition of the embankment is good, the only preparatory work necessary is to construct the jacking frame, place the guide timbers at the proper elevation and install a firm backstop frame capable of offsetting any movement when the jacks are in operation. The frame should be constructed to cover the entire diameter of the pipe, with a strut on each side of the pipe near the ground and a brace installed firmly at the top of the pipe, the length being approximately 6 ft., but depending on the diameter of the pipe. Then a 12-in. by 12-in. or 14-in. by 14-in. timber is laid across the two jack struts and braces at the end for headblocks where the head of the jack will work continuously, with taking-up blocks inserted between the head of the jack and the backstop.

Only one jack is necessary for all but the largest sizes of pipe. It should be a 35-ton jack of the high-speed type. Where two jacks are used, the labor cost is increased; also, in many cases the pressures from the two jacks are not equalized, and this often causes buckling of the frame or of the pipe because of the eccentric loading.

Only four men are necessary to carry out the entire operation of jacking pipes 36 to 42 in. in diameter, except where conditions require more men for placing the pipes on the guide timbers. For diameters 48 to 60 in., and larger, six men can be employed economically, two digging and loading wheelbarrows, two removing the dirt from the pipe and disposing of it, and two operating the jack and keeping the blocking placed. When a jack is to be reset, a strut should be installed on each side and all of the space should be taken up by means of wooden wedges while the jack is being reset.

It is important that clearance of about one inch be maintained around the top and sides of the pipe at all times. Also, a small trench, 6 to 8 in. wide and several inches deep, should be dug every 6 to 8 ft. to provide a place for the dirt that will be rolled up as the pipe is moved forward. If this is done, the pipe can be jacked through with surprisingly small variation from the selected gradient and alinement.

After the jacking frame is completed, the force stipulated, which includes an assistant foreman, should experience no trouble in installing culverts up to 100 ft. long. With the larger sizes, it may be necessary to increase the capacity of the jack, but if the work is done as outlined, only a slight increase will be needed.

Many Details

By A. M. Knowles
Assistant Engineer of Structures, Erie, Cleveland, Ohio

When a pipe is to be jacked through an embankment, the first step is to excavate a shaft at one end of the site of the culvert to the depth the pipe is to be placed, provided the bottom of the culvert is below natural ground. One side of the shaft can then be used as a resisting surface for the jacks to react against. This shaft should be long enough to permit placing one or two selections of pipe, a jack, a jacking frame and a timber jacking head in line with the axis of the culvert, and wide enough to admit the culvert pipe with room to work around it. If the bottom of the culvert is not much, if any, below the natural ground, a timber dead man is usually provided that is capable of resisting the jacking force.

To start the jacking operation, one jack against the bottom of the pipe is usually sufficient to move the pipe and, as the work progresses, other jacks are added and a wooden jacking head is usually placed over the end of the pipe to distribute the pressure from the jacks and form a cushion on the pipe. A gang of four to six men with a foreman is usually required to carry on the jacking job adequately. This provides the force necessary to handle the pipe sections, to excavate the heading, to move the earth through the pipe and to operate the jacks.

Thirty-inch pipe is the smallest that can be placed in this way with men of

ordinary size doing the excavating, although pipe 24 in. in diameter can be placed with selected small men to do the digging inside the pipe. Pipe as large as 60 in. has been placed successfully by the jacking method. Care must be taken not to excavate too far beyond the head end of the pipe. This distance varies with the type of material encountered and the amount of cover over the pipe, below the track. It will vary from 6 to 24 in. A steel cutting ring is sometimes used on the forward end of the pipe.

There probably is a limit to the length of pipe culvert that can be jacked into place, but I do not know what this limit is, for it depends on several factors, one of which, very important, is the character of the material in the embankment, within the area to be occupied by the culvert. Long culverts can be started from both sides of the embankment and meet up at the center of the culvert, but great care is necessary to maintain the two sections in accurate line so they will match properly when they join.

Extra Gangs for Maintenance

Are there advantages in employing an extra gang for general maintenance on each roadmaster's district during the working season? Any disadvantages? Why?

Prefers Section Gangs

By A. B. Chaney
District Engineer, Missouri Pacific, Little Rock, Ark.

Extra gangs are generally used for the heavier classes of maintenance tasks, such as laying rail, ballasting, out-of-face surfacing and track construction. When and where they shall be employed are based on the requirements for these classes of work. By reason of their size, equipment and freedom from patrol and other routine tasks, extra gangs are better for the more sizeable jobs than the regular section gangs. Section gangs should normally take care of general maintenance, but if for any reason this becomes impracticable, the use of an extra gang may become necessary.

Under the foregoing circumstances, it may be that the use of one or more extra gangs for varying periods will be necessary on one district, while on another no extra gangs are required. Briefly, the question of using extra gangs is one of matching the proper force with the task, and is influenced by conditions other than the limits of a roadmaster's district.

No General Answer

By Roadmaster

Whether it will be economical or otherwise satisfactory to organize an extra gang for general maintenance on each roadmaster's or supervisor's district depends on so many factors and so largely on local conditions that I doubt whether a general answer can be given that will be applicable to the majority of cases. Certainly, I would hesitate to say either yes or no categorically to the question, although I can think of several convincing arguments on both sides.

I myself have found three extra gangs assigned to general maintenance to be none too many under certain circumstances, while under other circumstances, with substantially the same mileage, I would have been hard put to utilize a single extra gang. It should be noted that in the former instance the extra gangs were not employed in building up substandard track, for track conditions were excellent.

I would be greatly surprised to find any advantage in the wholesale assignment of extra gangs for general maintenance, but I am equally doubtful of any blanket veto of such an arrangement. In other words, this is not a matter that can be decided categorically for an entire railway, for a region of a road or even one division.

The decision must be made for each district individually and based on the program for the year, on the local labor supply, on the need for power machines in performing the work, on both general and specific track conditions, on the speed, density and character of traffic, on the materials that are available and on other conditions that may be temporary or permanent, or of fluctuating importance.

Conserving Wire Screens

In view of the restrictions now being placed on civilian uses of copper, what methods can be employed to prolong the life of iron-wire screens?

Will Last Many Years

By Frank H. Soothill
Chief Estimator, Illinois Central, Chicago

By applying the following rules, the service life of new iron-wire screens may be extended to 15 to 20 years, assuming that they are not damaged mechanically before the end of this period. Also the life of old iron-wire screens that do not yet show signs of rust may also be extended.

1. All screens should be removed from windows and doors at the end of the summer season.
2. Each year, immediately following removal, the frames should be repaired, sagging wire should be made taut and screen mouldings should be secured in place.
3. Screens should be cleaned thoroughly each year, following which the screen wire should be given a coat of boiled linseed oil or coated with a good grade of screen enamel. Screen frames should be painted every three years, preferably with a good grade of exterior house paint.
4. Following the repair and painting of the screens, they should be stored in a clean dry place where neither the frames nor the wire will be subject to mechanical injury.
5. The maintenance of screen wire in doors and, in many instances, in windows, where they may be subject to mechanical injury through use, may be protected by the application of hardware cloth over the screen wire.

The conservation of screen wire is a timely problem and one that, if given proper consideration now, may eliminate considerable discomfort later on by reason of lack of screen protection.

Only a Starter

By Supervisor of Bridges and Buildings

I consider this an excellent subject for discussion, for it is only a forerunner of many other subjects that must be given similar consideration in the near future. As I think the question over, I cannot think of a single item that ought to be done now that we should not already have included in our regular practices. Obviously, however, what we must do now in the problem under consideration, and in

others that will come up later, will be done with far greater appreciation of the value of our actions in conserving material and, incidentally, in reducing overall costs of maintenance. From this point of view, our situation with respect to the availability of some materials may not be an unmitigated evil.

As mentioned, all of the precautions that should be taken now to extend the life of the screen wire should have been taken heretofore. In the first place, screens should not be put up before they are needed in the spring or early summer and they should not be left in place after the need for them is over in the fall. As soon as they have been removed from the doors and windows, they should be given any repairs that may be needed; this will do more to conserve their life than any other item except painting. The frames should be made rigid and the screen wire should be drawn taut. Both the frames and the wire should be cleaned and washed thoroughly, using soap if necessary, and dried as quickly as practicable.

As soon as the wood and the wire have dried, they should be painted. The wire should be given a coat of boiled linseed oil without pigment, or if some color is desired an inert pigment may be used. In any event, enough thinner should be used to prevent the clogging of the meshes of the wire with the paint. The frames can then be painted with exterior house paint of the desired color.

After the paint is dry, the screens should be stored in a clean dry place where they will be safe from injury until they are to be used again the following spring. If the screens are new, this careful treatment will extend their life for many years; I hope far beyond the present emergency. If they have already seen considerable service, considerable life can be added by careful treatment.

How to Get Maximum Output

What methods should be employed to insure that the maximum output is obtained from power machines and tools? Who should be responsible?

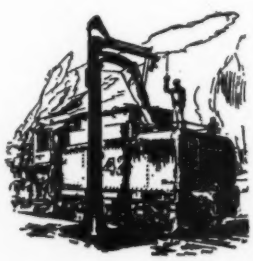
Keep in Good Condition

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Every supervisory officer should be seriously concerned about getting the greatest output from his power machines and tools. The first step necessary to secure this is to have them put in first-class operating condition and then to keep them in this condition. It is also essential that the machine be placed in charge of an experienced and reliable employee who appreciates the value of the equipment and who will assume responsibility for keeping it in good order. He should be familiar with the machine and know how to make needed adjustments and where and when lubricants should be applied, as well as the correct lubricants to use on different parts.

We have many different kinds of power machines and tools in operation over the system, some of which cannot be operated long or continuously at one point, or on one district or division. Under these conditions, it becomes necessary for every supervising officer who has work for a particular machine, to co-operate in placing or passing it along so that it can be kept in continuous use. Some light equipment, such as paint-spray outfits, concrete mixers, circular and chain saws, air compressors, generators and boring machines cannot be used continuously by one gang or even on one division. Such equipment should be moved from one gang to another or from one division to another in such a way that it can be employed to the greatest advantage.

Power machines, whether light or heavy, that lie idle represent investment that is bringing no return. In fact, they represent an actual loss for interest, depreciation, obsolescence and other overhead items go on constantly, whether the equipment is in active use or is idle. Little or no saving can be expected from power machines and tools unless they are kept in continuous use during the working season. Work should be programmed so that when a machine is sent to a division, maximum output will be assured if the schedule is followed rigidly. Obviously, such machines as spike pullers, spike drivers, tie adzers, heavy air compressors, and sometimes rail cranes and bolt tighteners, can be used to maximum capacity only when they are transferred from one division to another as the program of work, such as laying rail or ballasting, progresses from one division to another.



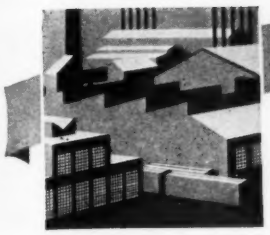
Purchase Judiciously

By C. H. R. Howe
Cost Engineer, Chesapeake & Ohio, Richmond, Va.

The first essential in obtaining maximum output from power machines and tools is the exercise of sound judgment in the purchase of the equipment. Buying machines simply because they do work faster than it can be done manually is no insurance that a saving will be effected. If machines lie idle for any considerable time, the savings may be wiped out. This can be avoided if the output capacity of the individual units is weighed against the total amount of work that is to be performed. Presurveys of situations sometimes disclose that by co-ordinating work programs, equipment can be transferred from one point to another, thus avoiding the purchase of surplus machines and thereby avoiding a reduction in the total output production of machines of the type in question. On the other hand, where heavy-duty equipment is in continuous operation, the possession of standby machines is readily justified as insurance against breakdown delays.

Proper operation and maintenance are always essential elements in machine output; during the present emergency they are not only essential, but they are vital. Worn-out equipment is non-productive and as the problem of securing repair parts becomes more difficult, every effort should be exerted to prolong the life of all machines, and of working parts in particular. Supervisory mechanics should see that all of the operators are instructed thoroughly in the adjustment and care of their machines, particularly with respect to lubrication.

Many maintenance officers would be greatly surprised to learn the low percentage of time that some of their machines are in actual use. It is suggested that they work up figures on this subject for their own edification. It should be the duty of every maintenance officer to see that maximum use is being made of the equipment under his jurisdiction. This can best be done by carefully surveying and programming each season's work, insisting that the program be carried out and, finally, seeing to it that the equipment is allocated to points needed and is not standing idle in some storehouse.



PRODUCTS of Manufacturers

Westinghouse Luminaires

THE Westinghouse Electric Manufacturing Co., Lighting division, Cleveland, Ohio, has recently developed Fresnel luminaires for lighting industrial fences and areas for protection against sabotage and new vapor-tight Millite luminaires for outdoor or indoor illuminating applications under extreme service conditions, where acid fumes, dust, smoke or excessive moisture are present.

The Fresnel luminaires consist basically of a hood with socket and receptacle, mounting bracket, a reflector and lens assembly. The hood is made of cast iron. The lower part of the casting has a flange for watershed and a breather to avoid creation of a vacuum due to sudden cooling of the luminaire by rain. Moisture-proof felt gaskets form a weatherproof and bug-proof seal between the hood and the reflector. Units with side mounting plates are gasketed with graphitized asbestos. The units can be mounted on poles and building walls. Two types are available, SF- or MF-180 for series and multiple circuits respectively.

Above——One of the New Fresnel Luminaires for Sabotage Protection. Below—the New Millite Incandescent Luminaire for High or Low Bay Areas

The Millite luminaires consist of three parts, a porcelain-enameled steel reflector available in several sizes, a socket assembly, and a hinged glass cover. The unit is arranged for conduit mounting. Reflectors for 300 and 500-watt sizes are made from 19 gage sheet iron, and the 750, and 1000-watt sizes are made from 18 gage sheet iron. Vapor-tight sealing is obtained with a heavy, treated asbestos gasket between the cover and the housing. An impact-resisting glass lens ¼-in. thick is designed to withstand sharp temperature changes and, if broken, shatters into small dull fragments rather than large pieces.

New Buda Sectionmaster

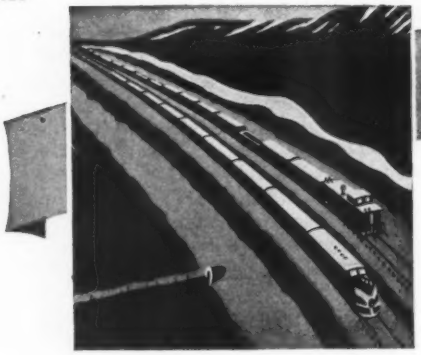
A new one- to eight-man light section motor car, Model G-1, has been developed by the Buda Company, Harvey, Ill., which is designed especially for section work with gangs ranging from one or two men up to six to eight men. The car has a strongly reinforced all-steel fully-welded frame, with rubber cushioned roller bearings, 16-in. cold-pressed steel wheels and four-wheel self-centering brakes with replaceable metal shoes. It is powered with a 4-cycle, air-cooled, 7.7 hp. Briggs & Stratton Model ZZP gasoline engine, which provides ample power for towing a push car with loads up to two tons. For pulling heavier tow loads, the car may be equipped with a special two-speed reduction gear. Power is transmitted to the drive wheels by a heavy-duty cone-type friction clutch mounted on ball bearings and a chain drive to the axle. The car has a load capacity of 1,200 lb., weighs 750 lb. and has a rear lift of 95 lb. It has an over-all length of 81 in., an over-all width of 63½ in., a height of 38 in. and a wheel base of 37 in.

The car is said to be strongly built and to be safe to operate. Patented skid rails located one inch above the rail head permit easy removal from the track and prevent the car from straddling the rail. The car has a long wide deck for seating the crew and an enclosed tool compartment under the rear of the center deck. Ample tool or floor space, 16 in. wide and 69 in. long, is provided on each side. The car is designed for economy of performance.

The Buda Model G-1 Light Section Motor Car Requires a Rear End Lift of Only 95 Lb.

Instant-Use Resurfacer

THE Flexrock Company, Philadelphia, Pa., has placed a new floor patching material on the market, named Instant-Use Resurfacer, which can be used as a floor patch or overlay on broken or rutted wood or concrete floors and which can be trucked over immediately following installation, permitting floors or platforms which cannot be taken out of service to be repaired with a minimum of delay or interference to traffic. Instant-Use Resurfacer is a tough plastic material, dark in color, which compacts under heavy truck loads. It comes ready to use, requiring no mixing, heating or auxiliary materials. It is shoveled into the hole to be repaired and tamped, preferably with an iron tamper. Traffic can then be run over the new installation immediately and the material is said to compact and improve in smoothness under the wheels of constant traffic. The material is also said to bond permanently to a feather edge and for that reason no chipping of concrete or ripping up of wood floors is required to make repairs.



NEWS of the Month

Railroads Place General Port Embargo in Effect

An embargo to prevent the movement of all commercial export freight to all Atlantic, Gulf and Pacific ports except when a permit has been obtained showing that ship space is available for such freight, was issued on April 15 by the Car Service division of the Association of American Railroads. The purpose of the embargo is to prevent freight from accumulating at ports. This embargo does not affect Army, Navy or lend-lease freight, nor does it affect freight shipments to those ports other than for export. Before the railroads will accept export freight for shipment, a permit must be obtained from George C. Randall, manager of port traffic, New York, or his designated representatives in New Orleans, La.; Atlanta, Ga.; Houston, Tex.; San Francisco, Cal.; Los Angeles or Seattle, Wash. The permit will be issued when a shipper shows that a definite steamship booking has been obtained.

Railroad Employment Continues to Gain

Railroad employment increased 1.85 per cent—from 1,168,795 to 1,190,416—during the one-month period from February to March, while the March total was 13.16 per cent above that for March, 1941, according to the Interstate Commerce Commission. March employment in all groups was above that of the previous month and of the corresponding month last year. Largest increases over March, 1941, were 16.07 per cent in the train and engine service group; 13.98 per cent in the maintenance of equipment and stores group; and 13.2 per cent in the maintenance of way and structures group. As compared with February, the largest increase was in the maintenance of way and structures group —up 4.53 per cent.

Minimum Load For Merchandise Cars

On March 24 the Office of Defense Transportation issued General Order ODT No. 1—Merchandise Traffic, which specified that between May 1 and July 1, minimum weight limits on loadings of l.c.l. cars would be fixed at six tons; between July 1 and September 1, at eight tons and thereafter at 10 tons. In an accompanying statement Director Eastman said that it was his judgment that "the average loading of merchandise cars should be increased to 12 tons per car, and the operation of trap and ferry cars within terminal districts should be drastically reduced, if not eliminated."

Railroads are forbidden by the order to forward any car with less than the prescribed tonnage, unless the car contains military materials, unless no other common carrier is available to transport the shipments to be contained in the car, or unless permission is granted by ODT to forward the car. If insufficient freight is available to bring the load of a car up to the required minimum within 36 hr. after the freight is received, the traffic must be diverted to another carrier; and all types of carriers—rail, motor, water, and forwarder—are required to accept and transport shipments diverted to them, to the extent of their available capacity and subject to certain terms and conditions set forth in the order.

Railroads' Allotments of Cars and Locomotives Reduced

On April 8, the War Production Board announced that materials would be allocated during the remainder of 1942 for the production of 18,000 freight cars and 300 locomotives, in addition to the 45,000 cars and 926 locomotives contemplated in the schedules running to May 1 which were approved on January 2 by the former Supply Priorities and Allocations Board. No assistance will be given for additional passenger car construction, but "materials will be made available to complete Army and lend-lease orders" for railroad rolling stock. This allocation followed an order, issued April 4, freezing all unfinished cars and locomotives in the hands of producers. At that time, the locomotive program authorized by SPAB was "ahead of schedule," but deliveries under the freight car program were delayed—19,000 cars remaining to be delivered by May 1. These 19,000 cars and the 18,000 others now authorized, along with locomotives hereafter produced, will now be rationed among using railroads by the WPB's Transportation Branch, "acting upon recommendations of the Office of Defense Transportation."

Concerning the allotment made by WPB for railroad equipment construction for the remainder of the year, Joseph B. Eastman, director of the Office of Defense Transportation, in an address at Philadelphia on April 9 indicated that he was not going to accept the WPB's meager estimate of the country's needs for transport materials and was going to continue to insist that the WPB quotas be raised. He hoped there would be "modifications."

Rails Hauling Nearly 600,000 Bbl. of Oil Daily

Rail movement of petroleum to the East set a new record of 586,350 barrels daily during the week ended April 11, according to an announcement by Petroleum Coordinator Harold L. Ickes. This was an increase of 11½ per cent over the preceding week when the movement averaged 525,697 barrels. Oil shipments by rail from California to the Pacific Northwest also increased during the week by about 12 per cent. About 43,500 tank cars are now engaged in the East Coast service.

Railroads Facing Labor Shortage

At a meeting on April 14, called by the Office of Defense Transportation to consider a program for dealing with "the growing manpower shortages," representatives of the Association of American Railroads were told that the problems of manning and maintaining the nation's railroads in the face of increasing labor shortages cannot be solved by draft deferment of employees.

"At best," said the ODT report on the meeting, "the representatives [of the A. A. R.] were told that granting of deferment to railroad employees must be considered only as an opportunity to train workers to replace those called to duty with the armed services. Training is also necessary, it was pointed out, to meet the increasing number of railroad employees made necessary by the growing demands placed on railroad transportation by the war effort." The ODT statement also listed "suggested self-help measures that might be adopted by the railroads" as follows:

1. Raising the hiring-age limits and relaxing physical requirements.
2. Making a drive to rehire former employees, including those who have quit and those who have retired.
3. Utilizing all state and federal aids to improve apprentice and learner training methods, and speeding up apprentice training by agreement with labor.
4. Surveying the situation on each railroad to determine possibilities of upgrading employees to more skilled positions and utilizing more skilled workers to instruct and guide semi-skilled workers.
5. Employing women wherever possible.
6. Making full use of governmental employment services.
7. Establishing a clearing-house by which the various railroads can exchange information on man power and self-help measures.
8. Organizing an effective personnel management system for each carrier under appropriate supervision and direction.

Personal Mention

General

H. A. Bennett, assistant engineer on the Baltimore & Ohio at Cincinnati, Ohio, has been promoted to assistant trainsmaster at Montezuma, Ind.

O. H. Woolwine, roadmaster on the Shenandoah division of the Norfolk & Western, with headquarters at Buena Vista, Va., has been promoted to assistant superintendent of that division, with headquarters at Roanoke, Va.

Adolph E. Kriesien, assistant general manager of the Eastern district of the Erie, with headquarters at Jersey City, N.J., and an engineer by training and experience, was promoted on March 17 to general manager of the Western district, with headquarters at Youngstown, Ohio. Mr. Kriesien was born at Paterson, N.J., on August 19, 1902, and attended a technical school at Newark, N.J. He entered railway service in July, 1920, as a rodman on the Erie at Youngstown, later being promoted successively to levelman, transitman and head of corps. On July 1, 1928, he was promoted to assistant division engineer of the New York Terminal division at Jersey City, N.J., and on November 16, 1933, he was appointed inspector of transportation at Cleveland, Ohio. Mr. Kriesien was promoted to trainmaster at Dunmore, Pa., on May 9, 1934, later being transferred successively to Jersey City and to Marion, Ohio. On February 1, 1938, he was promoted to superintendent of the New York Terminal division at Jersey City, later being transferred successively to Buffalo, N.Y., and Salamanca, N.Y. On October 16, 1940, he was promoted to assistant general manager of the Eastern district, with headquarters at Jersey City.

Adolph E. Kriesien

Donald Y. Geddes, whose promotion to assistant to the general manager of the New York zone of the Pennsylvania, with headquarters at New York, was reported in the March issue, was born in Chandlersville, Ohio, on August 24, 1885, and was graduated in civil engineering from Ohio State University in 1907. During the summers of 1903 and 1904, he was employed as rodman and instrumentman on the Ohio River & Western (now part of the Pennsylvania), and during the summers of 1905 and 1906, he worked in the office of the chief engineer at Zanesville, Ohio. In June, 1912, Mr. Geddes was appointed assistant to the general manager and in July, 1912, became superintendent. In October, 1918, he was transferred to Peoria, Ill., as superintendent of the Pittsburgh, Cincinnati, Chicago & St. Louis (now part of the Pennsylvania), becoming superintendent of the South Bend division of the same road in March, 1920. Mr. Geddes became superintendent of the New York division of the Pennsylvania at Jersey City on July 1, 1928.

Donald Y. Geddes

Lawrence E. Thornton, whose promotion to superintendent of the Baltimore & Ohio Chicago Terminal and the Chicago terminal of the Alton, with headquarters at Chicago, was reported in the March issue, was born at Browning, Ill., on August 7, 1900, and attended Miami University in 1920 and 1922. He entered railway service on the Chicago, Burlington & Quincy in September, 1923, and two years later, went with the Alton as an assistant engineer at Springfield, Ill. In January, 1930, he was promoted to assistant engineer in the chief engineer's office at Chicago and on January 1, 1932, he was appointed assistant division engineer of the Eastern division, with headquarters at Bloomington, Ill. On July 1, 1939, Mr. Thornton was promoted to assistant trainmaster at Bloomington and on August 16, 1940, he was advanced to trainmaster, with the same headquarters, which position he held until his recent promotion.

Lawrence E. Thornton

Paul W. Triplett, whose promotion to superintendent of the Delmarva division of the Pennsylvania at Cape Charles, Va., was reported in the March issue, was born at Elkins, W. Va., on May 14, 1904. He attended La Salle Institute at Cumberland, Md., and graduated in civil engineering from the University of Maryland in 1927. Mr. Triplett entered the service of the Pennsylvania as an assistant on the engineering corps at Washington, D. C., on June 25, 1927, and on June 16, 1928, he was transferred to the New York division. On September 8, 1928, he was appointed assistant supervisor of the Middle division at Hollidaysburg, Pa., and on January 1, 1929, he was transferred to the Philadelphia division at Lamoyne, Pa. He returned to the Middle division as assistant supervisor on March 25, 1929, and on August 1, 1929, he was promoted to supervisor of the Cresson division, which position he held successively on the Sunbury, Maryland, Atlantic and Chicago Terminal divisions. On March 1, 1938, he became assistant division engineer of the New York division at Jersey City, N. J., and was promoted to division engineer of the Renovo division on April 1, 1939. On April 11, 1940, he became division engineer on the Long Island, which position he held until his recent appointment.

Paul W. Triplett

H. L. Bell, whose promotion to assistant superintendent of the Victoria division of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Victoria, Tex., was reported in the April issue, was born at Edmond, Okla., on July 21, 1894, and attended the Central Teachers College of Oklahoma and Rice Institute, Houston, Tex. He entered railway service in 1919 as an engineer in the valuation department of the Southern Pacific, being appointed assistant engineer in 1920. In September, 1921, he was promoted to roadmaster and in January, 1924, he was advanced to division engineer. Mr. Bell was promoted to assistant superintendent in 1928 and in April, 1933, he was made trainmaster. In November,

1935, he was appointed division engineer at Victoria, Tex., which position he held until his recent promotion.

Albert Henry Woerner, whose promotion to superintendent of the Indianapolis division of the Baltimore & Ohio, with headquarters at Indianapolis, Ind., was reported in the April issue, was born at Philadelphia, Pa., on January 6, 1888, and graduated from the University of

Albert Henry Woerner

Pennsylvania in 1909. After graduation he went with the McClintic-Marshall Bridge Company at Pottstown, Pa., and on January 1, 1910, he entered railway service on the engineer corps of the B. & O. at Wheeling, W. Va.., later being transferred to Pittsburgh, Pa., and then being promoted to assistant supervisor of track at Havre de Grace, Md. In 1913 Mr. Woerner was promoted to assistant division engineer at Philadelphia, Pa., later being transferred successively to Baltimore, Md., Connellsville, Pa., and Wheeling. On June 1, 1918, he was advanced to division engineer at Wheeling and on January 1, 1925, he was transferred to the St. Louis division, with headquarters at Washington, Ind. Mr. Woerner was transferred to the Chicago division, with headquarters at Garrett, Ind., in February, 1930.

Engineering

F. E. Wall, instrumentman on the Alton at Bloomington, Ill., has been promoted to assistant engineer in the office of the chief engineer at Chicago.

Norman D. Bloom, roadmaster on the Atchison, Topeka & Santa Fe at La Junta, Colo., has been promoted to acting division engineer, with headquarters at Las Vegas, N.M., succeeding **H. E. Wilson,** who has entered military service.

F. N. Beighley has been appointed division engineer of the Northern division of the St. Louis-San Francisco, with headquarters at Fort Scott, Kan., succeeding **Benjamin H. Crosland,** who has entered military service.

H. S. Lowe, instrumentman on the Palestine division of the International-Great Northern (Missouri Pacific), has been promoted to assistant engineer at Palestine, Tex., succeeding **Leroy M. Elledge,** whose promotion to division engineer at Houston, Tex., was reported in the February issue.

C. F. Thomas, resident engineer of the Spokane, Portland & Seattle, with headquarters at Portland, Ore., has been appointed office engineer, with the same headquarters, a newly created position, and **L. K. Needham,** roadmaster at Portland, has been promoted to resident engineer, succeeding Mr. Thomas.

J. L. Cox, assistant engineer in the office of the district engineer on the New York Central at Cleveland, Ohio, whose transfer to the Lines Buffalo and East was reported in the April issue, has been appointed special engineer, system, in the office of the engineer maintenance of way, system, with headquarters at New York.

Louis Rossman, assistant division engineer on the Erie, with headquarters at Hornell, N. Y., has been promoted to division engineer, with headquarters at Dunmore, Pa., succeeding **W. F. Petteys,** who has entered military service. **Arthur E. Price,** assistant division engineer, with headquarters at Huntington, Ind., has been transferred to Hornell to succeed Mr. Rossman.

Henry C. Archibald, who has been appointed assistant to the chief engineer of the Boston & Maine, with headquarters at Boston, Mass., as reported in the April issue, was born on July 26, 1891, at Everett, Mass. He was educated at the

Henry C. Archibald

Tufts College engineering school, graduating in 1915, and entered the service of the B. & M. on June 15 of that year as a structural draftsman. From 1917 to 1919, Mr. Archibald served with the A. E. F. in France, returning to the B. & M. at the end of this period as structural draftsman. In 1925, he was appointed supervisor of bridges and buildings, and in 1928 he was advanced to assistant division engineer, being further promoted to division engineer in 1929. On November 15, 1941, Mr. Archibald became acting engineer of track, which position he was holding at the time of his recent appointment, effective March 16.

L. P. Struble, assistant to the chief engineer of the Central region of the Pennsylvania at Pittsburgh, Pa., has been promoted to chief engineer of the Eastern region, with headquarters at Philadelphia, Pa., to succeed **William B. Wood,** who has been appointed resident engineer at Baltimore, Md. Mr. Struble was graduated from Lehigh University and entered the service of the Pennsylvania on No-

L. P. Struble

vember 22, 1909, as a draftsman in the office of the chief engineer maintenance of way at Pittsburgh. Mr. Struble was engineer in charge of the construction of the present facilities and elevated track lay-out at Newark, N.J. Following the completion of this improvement, he was appointed assistant to chief engineer of the Central region at Pittsburgh in June, 1938, which position he held until his recent promotion.

Clayton R. Uitts, whose promotion to assistant division engineer of the Ft. Wayne division of the Pennsylvania, with headquarters at Ft. Wayne, Ind., was reported in the March issue, was born at Kokomo, Ind., on October 1, 1903, and graduated from Purdue University in 1925. He entered railway service on April 12, 1928, as an assistant on the engineering corps of the Chicago Terminal division of the Pennsylvania, and on July 23, 1929, he was promoted to assistant supervisor of track on the Schuylkill division, later being transferred to the Philadelphia, the Philadelphia Terminal and the Middle divisions. In June, 1934, Mr. Uitts was promoted to supervisor of track at New Castle, Pa., later being transferred successively to Camden, N.J., and Jersey City, N.J. He was located at the latter point at the time of his recent promotion.

C. Baker, assistant engineer on the Gulf Coast Lines (Missouri Pacific) at Kingsville, Tex., has been promoted to assistant division engineer, with headquarters at De Quincy, La., and **H. A. March,** assistant engineer at Harlingen, Tex., has been transferred to Kingsville, succeeding Mr. Baker. **J. H. Brosette,** instrumentman at Kingsville, has been promoted to assistant engineer at Harlingen, relieving Mr. March.

W. R. Ganser, master carpenter of the New York division of the Pennsylvania, with headquarters at Jersey City, N. J., has been appointed engineer of the Washington (D. C.) terminal, succeeding **J. J. Clutz,** who has entered military service. **M. C. Bitner,** division engineer of the Erie & Ashtabula division, with headquarters at New Castle, Pa., has been transferred to the New York division,

with headquarters at Jersey City, N. J., to succeed **D. E. Rudisill,** who has been transferred to the office of the chief engineer at Philadelphia, Pa.

Timothy G. Sughrue, engineer maintenance of way of the Maine Central and the Portland Terminal Company, with headquarters at Portland, Me., has been promoted to chief engineer of the Boston & Maine, the Maine Central and the Portland Terminal Company, with headquarters at Boston, Mass., succeeding **W. F. Cummings,** whose death on April 9 is reported elsewhere in these columns. **Stanley G. Phillips,** division engineer of the Terminal division of the B. & M. at Boston, has been promoted to engineer maintenance of way of the Maine Central and the Portland Terminal Company, with headquarters at Portland, to succeed Mr. Sughhrue. These appointments became effective on April 15.

Effective April 21, **Harold S. Ashley,** division engineer of the Portland division of the B. & M., was transferred to the Terminal division at Boston, to succeed Mr. Phillips, and **Harold F. Tupper,** acting engineer of track, with headquarters at Boston, has been appointed division engineer of the Portland division, with headquarters at Dover, N.H., to succeed Mr. Ashley. **Guy H. Watson,** engineer of track, with headquarters at Boston, who has been on leave of absence, has returned to active service.

Timothy G. Sughrue

Mr. Sughrue was born in Nashua, N.H., on February 22, 1889, and entered railroad service in June, 1906, as a section man on the Boston & Maine during summer vacation after graduating from Nashua high school. He attended the University of New Hampshire and during summer vacations in 1906 and 1907 worked as a yard clerk and sectionman with the Boston & Maine. In 1909, after graduation, he was appointed chainman, becoming a rodman in 1910, a draftsman in 1911, assistant supervisor of bridges and buildings in 1914 and supervisor of bridges and buildings in 1918. Mr. Sughrue was appointed division engineer of the Terminal division of the Boston & Maine in 1927 and in 1939 he was appointed engineer of maintenance of way of the Maine Central and Portland Terminal, which positions he held until his recent promotion.

Clyde Parker Nicholson, whose promotion to assistant chief engineer of the Norfolk Southern, with headquarters at Norfolk, Va., was reported in the April issue, was born on December 13, 1898, at Norfolk. He attended Virginia Military Institute and entered railroad service on July 1, 1919, with the Norfolk Southern, serving as rodman and chainman on track work and property lines. On March 30, 1921, he became a draftsman in general office work. From June 1, 1923, to June 1, 1933, Mr. Nicholson was draftsman in charge of estimating and designing tracks, roadway, buildings and bridges and from June 1, 1933, to May 1, 1936, he was assistant engineer in charge of office work and forces. From May 1, 1936, to August 1, 1937, he was division engineer in charge of maintenance of way and structures of the Northern division, and on the latter date he became engineer maintenance of way and structures for the system.

Clyde Parker Nicholson

C. N. Billings, whose promotion to division engineer of the Victoria division of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Victoria, Tex., was reported in the April issue, was born at Jetmore, Kan., on October 1, 1898, and graduated in civil engineering from the University of Washington, Seattle, Wash., in 1923. From 1915 to 1923, during vacations from school, Mr. Billings served as rodman and draftsman on the Portland division of the Southern Pacific. Immediately following his graduation he became an instrumentman on the Lafayette division of the Texas and Louisiana lines, being promoted to resident engineer on the Rio Grande Valley extension of the S. P. in 1926. During May and June of 1927, Mr. Billings was on special flood control work in Louisiana, and in July of the same year he was appointed assistant division engineer of the Beaumont division. In 1931 he was promoted to supervisor of bridges and buildings, with headquarters at Victoria, Tex., and he was later transferred to Ennis.

C. N. Billings

Lewis Paul Drew, whose promotion to bridge engineer of the Union Pacific, with headquarters at Omaha, Neb., was reported in the March issue, was born at Clarion, Iowa, on July 7, 1891, and graduated in civil engineering from Iowa State College, Ames, Iowa, in 1912. He entered railway service in 1910 as a bridge carpenter on the Oregon Short Line and in September, 1912, he was appointed instrumentman and draftsman on the O.S.L. He left a year later to become a construction foreman for the Pittsburgh-Des Moines Bridge Company, and from September, 1915, to June, 1916, he served as professor of mathematics at Adrian (Mich.) College. On the latter date, Mr. Drew returned to the O.S.L., serving as draftsman and assistant engineer until January, 1924, when he was promoted to bridge engineer of the Los Angeles & Salt Lake (now part of the Union Pacific system). In 1931 he was appointed bridge engineer of the L. A. & S. L., the O.S.L., and the Oregon-Washington Railroad & Navigation Co. (also part of the Union Pacific system) and in 1934 he was appointed bridge inspector for the Union Pacific at Omaha, which position he held until his recent promotion, except for a short period in 1941, when he was division engineer of the Colorado division.

Lewis Paul Drew

Jesse Phillips Dunnagan, whose promotion to engineer of bridges of the Southern Pacific, Pacific Lines, with headquarters at San Francisco, Cal., was reported in the April issue, was born at St. Louis, Mo., on January 1, 1888, and graduated from Leland Stanford Junior University in May, 1914. He then went to work for the bridge department of the California Highway Commission at San Francisco, and on June 17, 1916, entered railway service as a structural draftsman in the

maintenance of way department of the Southern Pacific at San Francisco. Mr. Dunnagan remained in the same department, eventually being promoted to engineer of structural design, in charge of

Jesse Phillips Dunnagan

the preparation of plans and specifications and the procurement of materials for bridges, grade separations, water service, and various other structures, except buildings, which position he held until his recent promotion on March 1.

H. M. Booth, engineer-roadmaster of the St. Louis, San Francisco & Texas (Texas lines of the St. Louis-San Francisco), with headquarters at Ft. Worth, Tex., has been promoted to division engineer on the St. Louis-San Francisco at Springfield, Mo., succeeding **Elmer L. Anderson,** whose promotion to assistant to the general manager at Springfield is reported elsewhere in these columns. **L. M. Harsha,** roadmaster at Oklahoma City, Okla., has been advanced to engineer-roadmaster at Ft. Worth, relieving Mr. Booth.

J. F. Dunseth, track supervisor on the Baltimore & Ohio at Newark, Ohio, has been promoted to assistant division engineer at Indianapolis, Ind., succeeding **H. F. Passel,** whose promotion to division engineer at Indianapolis was reported in the April issue. **W. T. Neale,** engineering assistant in the maintenance department, has been advanced to assistant engineer at Cincinnati, Ohio, replacing **H. A. Bennett,** whose promotion to assistant trainmaster at Montezuma, Ind., is reported elsewhere in these columns.

James M. Fair, engineer maintenance of way of the Western Pennsylvania division of the Pennsylvania, has been promoted to assistant chief engineer maintenance of way of the Central region, with headquarters as before at Pittsburgh, Pa., succeeding **William E. Brown,** whose death on March 10 was reported in the April issue, and **L. E. Gingerich,** division engineer in the office of the chief engineer at Philadelphia, Pa., has been advanced to engineer maintenance of way of the Western Pennsylvania division, succeeding Mr. Fair.

Howard F. Passel, whose promotion to division engineer of the Indianapolis division of the Baltimore & Ohio, with headquarters at Indianapolis, Ind., was reported in the April issue, was born at Cincinnati, Ohio, on January 23, 1883, and graduated in civil engineering from the University of Cincinnati in 1905. He entered railway service on April 1, 1901, as a rodman on the Cincinnati, Hamilton & Dayton (now part of the Baltimore & Ohio) and from 1902 to 1903 served as assistant engineer. On January 1, 1906, he was appointed division engineer and on December 1, 1915, when the Cincinnati, Indianapolis & Western (previously controlled by the C. H. & D.) was reorganized, Mr. Passel was appointed chief engineer of the C. I. & W., with headquarters at Indianapolis. On June 1, 1926, after the B. & O. purchased control of the C. I. & W., Mr. Passel was appointed division engineer on the B. & O., with the same headquarters, and on July 1, 1932, he was appointed assistant division engineer at Indianapolis, holding that position until his recent promotion, effective March 1.

John Schofield, architect of the Canadian National, with headquarters at Montreal, Que., has been promoted to chief architect of the system, with the same headquarters. Mr. Schofield was born in Monaghan, Ireland, where he served an architectural apprenticeship. After further studies in Dublin, he went to Canada in 1904, subsequently entering the service of the Canadian Northern (now Canadian National). In 1923 he was appointed architect for the Canadian National and with the formation of Trans-Canada Air Lines in 1937 he was also appointed architect for that organization. Mr. Schofield has been responsible for the design and construction of many of the larger stations on the Canadian National, including the new Terminal station at Montreal. He has also been associated in many Canadian National hotel developments, including the resorts in Jasper National Park, Minaki Lodge in the Lake of the Woods district and hotels at Halifax, N.S., Saskatoon, Sask., Vancouver, B.C., and Charlottetown, P. E. I. Since the commencement of the war his services have also been utilized by the Department of Transport and the Department of Munitions and Supply; the British Ministry of Aircraft Production and the Royal Air Force Ferry Command.

John Schofield

John P. Cronin, whose promotion on March 16 to engineer of design of the Boston & Maine, with headquarters at Boston, Mass., was reported in the April issue, was born on June 28, 1888, at Worcester, Mass. Mr. Cronin graduated from the University of Maine in 1912. He entered railway service as a draftsman, with

John P. Cronin

the B. & M. on June 24 of that year, retaining this position until October, 1917, when he entered the army, serving with the A.E.F. in the 170th Aero squadron. In June, 1919, Mr. Cronin returned to the B. & M. as a draftsman, being advanced to general draftsman on October 1, 1920. On April 16, 1928, he was promoted to assistant engineer, and on February 16, 1929, he became office engineer in the office of the chief engineer.

J. M. Giles, supervisor of bridges and buildings on the Missouri Pacific at St. Louis, Mo., has been promoted to division engineer, with headquarters at Wichita, Kan., succeeding **E. B. Fithian,** who retired from active service on April 1. Mr. Fithian was born at Greenwich, N.J., on February 4, 1872, and graduated from Rutgers College in 1896. He entered railway service on September 1, 1896, in the engineering department on the New York division of the Pennsylvania and later served as assistant to the division engineer and office engineer at Altoona, Pa., and assistant supervisor. In August, 1903, he went with the Baltimore & Ohio as maintenance of way inspector, later being promoted to assistant division engineer and division engineer. In October, 1908, Mr. Fithian went with the Missouri Pacific as division engineer of the Central division and was later transferred successively to the Arkansas and Missouri divisions. In January, 1923, he was promoted to district engineer, with headquarters at Kansas City, Mo., and in February, 1926, his title was changed to assistant engineer maintenance of way. A year later, he was appointed division engineer at Wichita.

Track

Thomas Scott, assistant track foreman on the New York Central (Big Four) has been promoted to assistant supervisor of track at Indianapolis, Ind.

R. R. Bonner, bridge inspector on the Kingsville division of the Gulf Coast Lines (Missouri Pacific), has been promoted to roadmaster on the Corpus

Christi subdivision, succeeding **William Weiland,** who retired on March 1.

Bernard M. Mercer, track foreman on the Syracuse division of the New York Central, has been promoted to assistant supervisor of track of Subdivision No. 1 of the Electric division, with headquarters at New York, succeeding **J. Dorsey,** deceased.

C. T. Meiff, track foreman on the Newark division of the Baltimore & Ohio, has been promoted to track supervisor at Newark, Ohio, succeeding **J. F. Dunseth,** whose promotion to assistant division engineer at Indianapolis, Ind., is reported elsewhere in these columns.

S. Kaster, extra gang foreman on the International-Great Northern (Missouri Pacific), has been promoted to roadmaster of the Mart subdivision, with headquarters at Valley Junction, Tex., succeeding **G. H. Morley,** who has been transferred to the Austin subdivision, with headquarters at San Antonio, Tex., replacing **D. Barksdale,** transferred.

J. T. Shepherd, assistant roadmaster on the Norfolk division of the Norfolk & Western, has been promoted to roadmaster of the Shenandoah division, with headquarters at Buena Vista, Va., succeeding **O. H. Woolwine,** whose appointment as assistant superintendent of that division is noted elsewhere in these columns.

William Lindsey, formerly a section foreman on the Pocahontas division, has been promoted to assistant roadmaster on the Norfolk division to succeed Mr. Shepherd.

M. M. Thomas, has been appointed roadmaster on the Union Pacific at Valley, Neb., with jurisdiction from Summit, Kan., to Columbus, Neb., and **M. C. Day,** section foreman at Cozad, Neb., has been promoted to roadmaster at Valley, with jurisdiction on the Beatrice and Stromburg branches. **Robert H. Archer,** assistant roadmaster at Omaha, Neb., has been promoted to roadmaster at Manhattan, Kan. **W. E. Johnson** has been appointed assistant roadmaster at Omaha, succeeding Mr. Archer, and **C. M. Wisemiller** has been appointed assistant roadmaster at Grand Island, Neb.

J. W. Sanders, assistant to the roadmaster on the Southern at Somerset, Ky., has been promoted to track supervisor at Lexington, Ky., succeeding **J. M. Boles,** who has been granted a leave of absence to enter military service, and **M. P. Oviatt,** student apprentice, has been advanced to assistant to the roadmaster at Somerset, replacing Mr. Sanders. **W. C. Johnson,** assistant track supervisor at Tuscaloosa, Ala., has been promoted to track supervisor at Huntingburg, Ind., relieving **J. G. Beard,** who also has been granted a leave of absence to enter military service, and **J. B. Hutcherson,** section foreman at Spring City, Tenn., has been advanced to assistant track supervisor at Tuscaloosa, succeeding Mr. Johnson.

R. E. Meyer, roadmaster on the Chicago & Northwestern at Mason City, Iowa, has been transferred to Sioux City, Iowa, succeeding **L. Gilbert,** who retired from actice service on April 1. **E. L. Hoffman,** roadmaster at Antigo, Wis., has been transferred to Mason City, effective April 27, relieving Mr. Meyer and **J. T. Peabody,** roadmaster at Tracy, Minn., has been transferred, effective May 1, to Antigo, replacing Mr. Hoffman. The headquarters of **William Nieman,** roadmaster of Subdivision No. 1 on the Dakota division have been transferred from Sleepy Eye, Minn., to Tracy and the position of roadmaster at Sleepy Eye has been eliminated.

C. L. Towle, assistant track supervisor on the New York division of the Pennsylvania, with headquarters at New York, has been promoted to track supervisor of the Pennsylvania-Reading Seashore Lines, with headquarters at Camden, N. J. **S. M. Rodgers,** track supervisor on the Wilkes-Barre division, has been transferred to the New York division, with headquarters at Trenton, N. J., to succeed **George Baylor,** who has entered military service. **William McCracken,** a signal apprentice on the New York Zone, has been promoted to assistant track supervisor on the New York division, with headquarters at Jamesburg, N. J., succeeding **A. B. Baker,** who has been transferred to the Pittsburgh division.

M. L. Horton has been appointed roadmaster on the Norfolk division of the Atlantic Coast Line, with headquarters at Rocky Mount, N. C., to succeed **J. H. Moore,** who has retired. Mr. Horton entered the service of the A. C. L. on December 8, 1924, as a laborer in the water supply department, becoming a helper on April 1, 1925. He was further advanced to mechanic on August 1, 1926, and in the following year he became a foreman in this department. In 1932, Mr. Horton was promoted to assistant supervisor of building repairs, which position he held until his recent appointment.

Charles B. Bonner, yard foreman on the St. Louis-San Francisco at West Tulsa, Okla., has been promoted to roadmaster at Oklahoma City, Okla., succeeding **L. M. Harsha,** whose promotion to engineer-roadmaster at Ft. Worth, Tex., is reported elsewhere in these columns. Mr. Bonner was born at Seneca, Mo., on February 1, 1891, and entered railway service on May 22, 1907, as a section laborer on the Frisco at Amber, Okla. On May 12, 1911, he was promoted to section foreman at Mustang, Okla., and on February 27, 1927, he was appointed extra gang foreman in charge of the construction of the West Tulsa yards, remaining at that point as yard foreman after construction was completed until his recent promotion, effective April 1.

James D. Sullens, whose promotion to track supervisor on the Southern at Pell City, Ala., was reported in the April issue, was born at Hackleburg, Ala., on July 9, 1909, and entered railway service on July 12, 1930, as a section laborer at Littleton, Ala. On July 13, 1937, he was promoted to section foreman at Cook Springs, Ala., and on June 1, 1941, he was advanced to assistant to the roadmaster at Somerset, Ky., which position he held until his recent promotion, effective March 1.

Francis V. McLarnon, whose promotion to roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Aberdeen, S.D., was reported in the February issue, was born at Freeport, Ill., on June 9, 1907, and entered railway service on May 5, 1923, as an extra gang timekeeper on the Milwaukee, working in that capacity during the summer months until June, 1926, when he became a regular section laborer. He then worked as section laborer, relief section foreman and assistant foreman on extra gangs on the Milwaukee division until October, 1934, when he was promoted to extra gang foreman. Mr. McLarnon was advanced to general foreman of extra gangs in May, 1939, which position he held until his recent promotion.

Richard Roach, whose promotion to track supervisor on the Illinois Central, with headquarters at Bluford, Ill., was ported in the March issue of *Railway Engineering and Maintenance* was born at Wickliffe, Ky., on December 15, 1900, and entered railway service on March 8, 1921, as a section laborer on the Illinois Central at Cairo, Ill. On September 15, 1922, he was promoted to assistant foreman in the Cairo yards and two years later he was advanced to section foreman at North Cairo, Ill. From September 12, 1936, to August 31, 1937, he was granted a leave of absence to work for the Missouri Pacific as extra gang foreman at Cairo, returning to the Illinois Central at Cairo on the latter date. On January 16, 1938, Mr. Roach was promoted to extra gang foreman on the Bluford district.

M. L. Conley, whose retirement as track supervisor on the Illinois Central, with headquarters at Freeport, Ill., was reported in the February issue of *Railway Engineering and Maintenance,* was born at Keithsburg, Ill., on April 26, 1885, and entered railway service on April 1, 1899, as a section laborer on the Illinois Central at Arcola, Ill., later being promoted to assistant section foreman. In March, 1904, he was advanced to section foreman at Arcola, and on December 28, 1907, he was transferred to Freeport. Mr. Conley continued as section foreman at Freeport with the exception of several months in 1910 and 1911 as acting track supervisor of the North Amboy district and several months in 1911 as general foreman on construction at Parkway, Ill., until July 18, 1912, when he was promoted to general foreman on construction at Berwyn, Ill. On October 1, 1912, he was advanced to track supervisor at Freeport.

Bridge and Building

H. H. Taylor has been appointed master carpenter of the Grand Junction division of the Denver & Rio Grande Western, with headquarters at Grand Junction, Colo., succeeding **L. B. Campbell.**

E. E. Martin has been appointed bridge and building supervisor on the Union Pacific at Kansas City, Mo. **B. E. Arnold** has been appointed bridge and building supervisor, with headquarters at Omaha, Neb.

J. C. C. Fischer, acting assistant master carpenter on the New York division of the Pennsylvania, with headquarters at Jersey City, N. J., has been promoted to master carpenter of the Delmarva divi-

sion, and **F. L. Lee,** a foreman carpenter on the Philadelphia division, has been promoted to assistant master carpenter of the New York division at Jersey City. **J. W. Rowland,** master carpenter of the Toledo division, with headquarters at Toledo, Ohio, has been transferred to the Long Island railroad, with headquarters at Jamaica, L. I., N. Y., succeeding **W. R. Taggart,** who has been transferred to the New York Zone division, with headquarters at Jersey City, N. J. Mr. Taggart replaces **W. R. Ganser,** whose appointment as engineer of the Washington (D. C.) terminal is noted elsewhere in these columns.

Special

L. W. Craus, supervisor of water service of the First district of the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, has had his jurisdiction extended to include the system, with headquarters at Kansas City, Mo.

W. E. Blake, inspector of work equipment on the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to supervisor of work equipment, Lines West, with headquarters at Seattle, Wash., succeeding **E. P. Sima,** who has been granted a leave of absence to enter military service. Mr. Blake entered the service of the Milwaukee as a locomotive crane operator in 1930, and in 1941 was appointed inspector of work equipment. His promotion was effective April 15.

Vaughn W. Oswalt has been appointed supervisor of work equipment on the Western lines of the Southern, effective April 13, with headquarters at Cincinnati, Ohio, succeeding **R. C. O'Mar,** who has resigned. Mr. Oswalt was born at Wabash, Ind., on January 7, 1898, and worked for the J. G. Brill Company from 1921 to 1925 as a service engineer and from 1925 to 1934 as a supervisor, supervising the installation of gas-electric railway cars and trains. In 1934 Mr. Oswalt went with Sperry Products, Inc., as a service engineer, working with rail detector cars, which position he held until his recent appointment.

Obituary

J. H. Lesch, supervisor of water service on the Chicago & Eastern Illinois at Danville, Ill., died suddenly of a heart attack at Evansville, Ind., on April 21.

John F. Murray, who was assistant chief engineer of the Pennsylvania system at Philadelphia, Pa., from March 1, 1920, to October, 1929, died on March 16 at his home in Moylan, Pa., at the age of 70.

William E. Brown, assistant chief engineer maintenance of way of the Central region of the Pennsylvania at Pittsburgh, Pa., who died on March 10, instead of on March 16, as erroneously reported in the April issue, was born on September 6, 1878, at Elma, N.Y., and graduated in civil engineering from Ohio Northern University in 1897. He entered railroad service on November 16, 1897, as chainman with the Western New York & Pennsylvania (now P. R.R.) and on August 1, 1899, he became a draftsman. He became a rodman on the Buffalo division on September 21, 1900, and on January 14, 1902, he became a transitman on the Eastern Pennsylvania division. On May 5, 1902, he was appointed assistant supervisor of the Conemaugh and Maryland divisons, being promoted to supervisor of the Philadelphia & Erie, Middle, and Pittsburgh divisions on July 12, 1905. Mr. Brown was appointed assistant division engineer of the Pittsburgh division of the Pennsylvania on July 1, 1917, being promoted to division engineer on February 1, 1918. He was appointed assistant chief engineer maintenance of way of the Central region on May 1, 1920.

William F. Cummings, chief engineer of the Boston & Maine, the Maine Central and the Portland Terminal, with headquarters at Boston, Mass., died at his home in Marblehead, Mass., on April 9, following an operation. Mr. Cummings was born in Charlestown, Mass., on December 9, 1887, and entered the service of the Boston & Maine on October 22, 1906, as a rodman in the engineering department. Advancing successively through various positions in this department, he became assistant engineer in the office of the valuation engineer on April 1, 1914. On January 1, 1921, he was promoted to valuation engineer and in January, 1926, he assumed the additional duties of auditor of disbursements. On April 1, 1926, he was promoted to engineer maintenance of way and on November 1, 1928, he was further advanced to assistant chief engineer of the B. & M. On August 1, 1936, Mr. Cummings was appointed also assistant chief engineer of the Maine Central and the Portland Terminal. On December 19, 1938, he was appointed acting chief engineer of all three of these companies and on February 1, 1939, was named chief engineer of the same lines. At the time of his death, Mr. Cummings was senior vice-president of the American Railway Engineering Association. Also he was a past director of the A. R. E. A., a past president of the New England Railroad Club and a member of the council of the American Standards Association, representing the Association of American Railroads.

William F. Cummings

Dr. Arthur Newell Talbot, professor emeritus of municipal and sanitary engineering of the University of Illinois, who was responsible for outstanding contributions to railroad research and progress as chairman for 27 years of the American Railway Engineering Association's committee on Stresses in Track, until his retirement in October, 1941, died suddenly of a stroke at the Passavant hospital in Chicago on April 3. Early in his career, Dr. Talbot developed a formula for areas of waterways of bridges and culverts and another formula for rates of maximum rainfall, both of which have been widely used and bear his name today. He later prepared a treatise on a flexible method of laying out easement curves, or spirals, at the ends of circular curves and several editions of this work were later published and his methods were used by many railroads. In the research on stresses in railroad track, which he directed for 27 years, reliable knowledge on the interrelation between track and rolling stock was developed and this information has aided in putting the design and construction of the track structure on a more rational basis.

Dr. Arthur Newell Talbot

Dr. Talbot was born at Cortland, Ill., on October 21, 1857 and graduated in civil engineering from the Illinois Industrial University (now the University of Illinois), in June, 1881. After graduation he engaged in railroad location, construction and maintenance in Colorado, New Mexico, Kansas and Idaho. In September, 1885, he returned to the University of Illinois as assistant professor of engineering and mathematics and taught a wide range of subjects. In 1890 he was promoted to professor of municipal and sanitary engineering, in charge of theoretical and applied mechanics. In September, 1926, when Dr. Talbot reached the age limit of the University, he retired from teaching and administration and was made professor of municipal and sanitary engineering, emeritus, but continued actively in directing an extensive research program, which included the research for the A. R. E. A. on stresses in railroad track. In October, 1941, he retired as chairman of the A. R. E. A. committee on that subject.

Dr. Talbot was the recipient of many honorary degrees and medals. In 1937 he was awarded the John Fritz Gold Medal, highest of American engineering honors, and was cited as a "moulder of men, eminent consultant on engineering projects, leader of research, and outstanding educator in civil engineering." He was an honorary member of the A. R. E. A. and served as a director of that association from 1915 to 1918 and again from 1928 to 1931.

(Continued on page 366)

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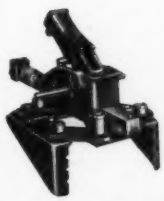

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Association News

Roadmasters' Association

The Executive committee held a meeting in Chicago on April 13, attended by President A. B. Hillman, First Vice-President E. L. Banion, Second Vice-President H. E. Kirby, Treasurer E. E. Crowley, Secretary A. G. Shaver, Director J. M. Miller, and Past-President Elmer T. Howson.

The committee reviewed the status of the work of the technical committees and of the association generally, and appointed F. J. Herlehy, roadmaster, Chicago, Milwaukee, St. Paul & Pacific, chairman of the committee to report on the Use of Track Grinders at the next convention, to replace J. J. Clutz, division engineer, Pennsylvania, who has been called into military service. The committee also accepted the applications of three for membership and took steps looking to the publication of an association bulletin at an early date. The 1941 Proceedings came off the press early in April, and every effort is now being made to get them into the hands of members quickly.

Bridge and Building Association

A full-day meeting of the Executive committee was held in Chicago on April 20, attended by President R. E. Dove, First Vice-President F. H. Soothill, Third Vice-President A. M. Knowles, Fourth Vice-President N. D. Howard, Treasurer F. E. Weise, Secretary A. G. Shaver, Directors R. E. Candle and M. Meyer, Past-Presidents H. M. Church, A. E. Bechtelheimer and Elmer T. Howson, and P. R. Austin, secretary of the Bridge and Building Supply Men's Association. At this meeting, the committee considered the status of membership at length and passed favorably upon eight applications, gave consideration to the status of work on the reports to be presented before the next convention, and transacted considerable association business of a routine nature.

About the middle of April, an issue of the B. & B. News was mailed to members. Work on the 1941 Proceedings is progressing rapidly and it is expected that copies can be distributed to members during the latter part of May. A feature of the Proceedings will be a bibliography of contents of the Proceedings of the association since 1910. In a change of plans made necessary by demands on the Hotel Stevens, selected for the next convention, the convention has been moved forward to October 13-15, instead of October 20-22.

American Railway Engineering Association

On April 9, the association lost through death its senior vice-president Wm. F. Cummings, chief engineer of the Boston & Maine, who died at his home at Marblehead, Mass., following an operation. A sketch of Mr. Cummings' railway career appears in the Personal News of this issue.

On April 1, the association's booklet containing the assignments and personnel of committees for the current year was mailed to all committee members, details relative to newly-appointed committee chairmen and new subject assignments having been reported in the April issue. The 1942 Proceedings of the association, covering the activities at the convention in March, is now on the press, and it is anticipated that copies can be distributed to members about June 1.

Three committees held meetings in April, all in Chicago, as follows: Water Service, Fire Protection and Sanitation, on April 21; Economics of Railway Labor, on April 21; and Maintenance of Way Work Equipment, on April 21 and 22. Three committees have thus far scheduled meetings during May, these being the Committee on Rail, which will meet at Chicago on May 7; the Committee on Iron and Steel Structures, which will meet at Columbus, Ohio, on May 14 and 15; and the Committee on Wood Bridges and Trestles, at Chicago on May 21.

Railway Tie Association

The Railway Tie Association will hold its twenty-fourth annual meeting at the Netherland Plaza Hotel, Cincinnati, Ohio, on May 6-7. In developing the program for this meeting, the officers have endeavored to key it to the critical problems of tie supply now confronting those in the industry and the railways who comprise their market. The program follows:

WEDNESDAY, MAY 6

Morning Session

Opening business
Address on The Railways in Times of National Emergency, by E. M. Hastings, chief engineer, R. F. & P., Richmond, Va.
Report of Committee on Manufacturing Practice
Report of Committee on Mechanical Equipment
Address on Production Problems of the Cross Tie Industry, by T. J. Turley, Jr., vice-president, Bond Brothers, Louisville, Ky.
Address on Ties in a Statistical Sense, by Dr. Julius H. Parmelee, director, Bureau of Railway Economics, A. A. R., Washington, D. C.

Afternoon Session

Report of Committee on Timber Conservation
Address on Labor as a Factor in Tie Production in 1942, by B. N. Johnson, Wood Preserving Division, Koppers Company, Richmond, Ind.
Report of Legislative Committee

WEDNESDAY EVENING—7:00 P. M.

Annual dinner—address on The Railways in War, by Col. R. S. Henry, assistant to the president, A. A. R., Washington, D. C.

THURSDAY, MAY 7

Morning Session

Report of Committee on Checking and Splitting
Address on The Maintenance of Standards in Period of Tie Scarcity, by W. D. Simpson, assistant chief engineer, maintenance of way, Seaboard, Norfolk, Va.
Address on The Maintenance Needs of the Railways in 1942, by H. R. Clarke, chief engineer, maintenance of way, C. B. & Q., Chicago
Report of Committee on Changes of Dimensions of Cross Ties During the Seasoning Period
Address on The Outlook for Preservatives as a Factor in Tie Supply, by John N. Forker, vice-president, Tar & Chemical Division, Koppers Company, Pittsburgh, Pa.
Closing business

Maintenance of Way Club of Chicago

Ralph Budd, president of the Chicago, Burlington & Quincy, and until recently, transportation commissioner and member of the Advisory Commission to the Council of National Defense, was the guest speaker at the Annual meeting of the club, which was held on April 27. At this meeting, which was preceded by a reception and dinner, a total of 178 members and guests were in attendance. In his address, which was on The Problems We Face On the Railways Today, Mr. Budd viewed with some concern the needs of the railways for materials, stressed the importance of keeping the railway plant in balance with war requirements, and urged those present to their greatest efforts in securing the maximum service from materials on hand and in inspiring maximum effort.

In the annual election of officers which followed the dinner, F. E. Schaumburg, roadmaster, Chicago & North Western, was advanced to president; F. G. Campbell, assistant chief engineer, Elgin, Joliet & Eastern, was elected first vice-president; V. G. Walling, division superintendent, Chicago Surface Lines, was elected second vice-president; and Neal D. Howard, managing editor, *Railway Engineering and Maintenance*, was re-elected secretary-treasurer. J. G. Wishart, principal assistant engineer, Chicago, Rock Island & Pacific; E. C. Vandenburgh, engineer of maintenance, Chicago & North Western; and C. P. Benning, sales representative, Fairmont Railway Motors, Inc., were elected directors for a term of two years. In addition, T. H. Strate, division engineer, Chicago, Milwaukee, St. Paul & Pacific, was elected a director for one year, to fill the vacancy created by the resignation of L. E. Gingerich, engineer maintenance of way, Western Pennsylvania division on the Pennsylvania, Pittsburgh, Pa., resigned. The membership of the club at the end of the year was 336.

Supply Trade News

Personal

Frank R. Wood, acting managing director of the **P. & M. Co., Limited,** Montreal, Que., has been appointed managing director to succeed **Gordon W. Dunn,** deceased. Mr. Wood has also been elected vice-president of **Engineering Materials, Limited,** Montreal, Que.

D. J. Williams, western railroad sales manager of the **Air Reduction Sales Company,** with headquarters at San Francisco, Cal., has entered the services of the U. S. Navy as lieutenant commander, and will be located in the Ninth Naval District, working with the Office of Material Procurement.

J. A. Krugler, general sales manager of the **Taylor-Wharton Iron & Steel Co.,** has been promoted to vice-president in charge of sales and purchases, with headquarters at Easton, Pa., and **J. L. Lonergan** has been appointed superintendent of the company's plant at Easton.

Obituary

George L. Dunn, southern central representative of the Railway Appliances Division of the American Fork & Hoe Company, died in Kent, Ohio, on March 20.

Fred J. Maeurer, for the past 13 years associated as a specialist with the applied engineering department of the Air Reduction Sales Company, died on April 13. Mr. Maeurer was associated with the oxyacetylene industry for nearly 33 years, having joined the Davis-Bournonville Company, Jersey City, N.J., in 1909 and continued therein when that company was acquired by Airco in 1922.

2 WAYS to LICK This Summer's BIGGER MAINTENANCE PROBLEMS!

WOOLERY TIE CUTTERS

The Woolery Machine cuts the tie in three pieces which are easily LIFTED (not dug) out.

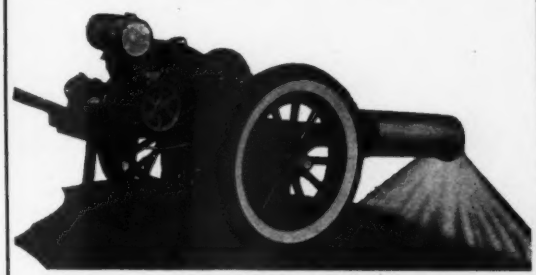
This Year—you will need all the help you can possibly get to complete your tie renewals in the face of record volume of wartime traffic, and a high turnover and scarcity of labor.

So, why not take advantage of the WOOLERY Tie Cutter Method of renewing ties? You can save up to 30% in time . . . in labor . . . in cost. Roads using these machines finish their programs weeks ahead of former schedules—and save thousands of dollars. You can do the same. Just ask for a FREE DEMONSTRATION on your road and convince yourself that these savings are real. Act Now!

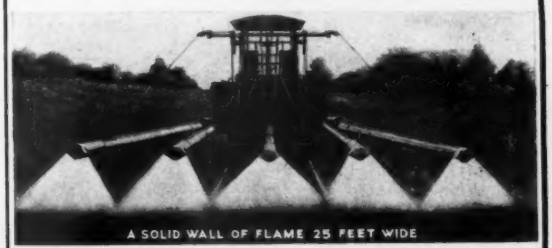
By cutting these ties into three pieces that can be easily lifted out, with minimum disturbance to track, the Tie Cutter eliminates "digging-out" of ties and trenching, reduces follow-up resurfacing 50% and leaves firm solid beds undisturbed for new ties to rest on. Ties can be renewed so quickly and easily with this machine that the wasteful temptation to renew ties prematurely for the sake of convenience is eliminated.

WOOLERY WEED BURNERS

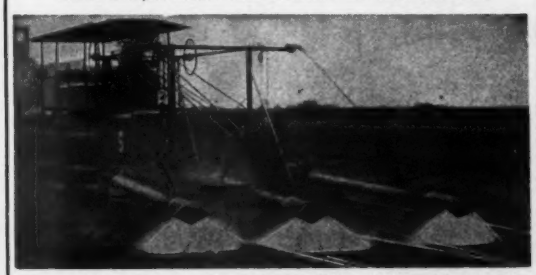
To handle successfully today's unprecedentedly heavy traffic, tracks must be kept in first-class shape . . . free of weeds and their harmful effects. By using WOOLERY WEED BURNERS, you can remove weeds quickly, thoroughly and economically . . . with minimum effort on the part of your busy track forces. The fact that 60 Railroads are now using Woolery Weed Burners is proof of their satisfactory performance. And there's a model to fulfill your specific needs.



Junior Portable Model for use on or off track.



Giant Octopus Model with 5 burners—for main line track



Giant Octopus Model with 3 burners. Midget Octopus Model with 2 burners for branch lines and terminals also available.

Pioneer Manufacturers of
RAILWAY MAINTENANCE EQUIPMENT
Tie Cutters Switch Heaters Motor Cars
Railway Weed Burners Bolt Tighteners

WOOLERY MACHINE CO.
Minneapolis Minnesota

FLEX-TOE CLAW BARS *Solve* YOUR SPIKE PULLING PROBLEMS . . . . .

HERE'S the claw bar which every track and bridge gang should have. Flex-Toe pulls spikes which the ordinary claw bar cannot conquer. Brine-eaten spikes, stubs, boat spikes, and drift bolts COME OUT QUICKLY. Throw Flex-Toe on spikes and manipulate it just as an ordinary bar. The toes of Flex-Toe grab tight hold automatically, and won't let go. It's a one man bar . . . no dangerous spike maul driving, no flying heads, no shimming under the heel. Flex-Toe will pay for itself many times over by saving time and reducing accidents. Write today for literature and prices. It will pay you.

WARREN TOOL CORP.
WARREN, OHIO

SKILSAW CUTS FASTER!

. . . cuts hours off maintenance schedules!

SKILSAW DRILLS

for wood boring, steel drilling and reaming!

Powered for deep wood boring in timbers—for lag spikes and hook bolts, for drilling and reaming in steel and a hundred other uses. Stronger, more durable, more powerful construction throughout.

23 MODELS

Bridge and Building Crews get more jobs done . . . in far less time . . . when they're equipped with fast-cutting SKILSAW. It speeds all sawing of wood, metal, stone and compositions . . . helps crews keep ahead of today's stepped-up maintenance and construction schedules.

SKILSAW goes right to each job for greatest savings in time and labor. Cuts daps in ties, cuts timbers, saws all lumber on bridges, trestles, guard rails, buildings and maintenance of way work.

SKILSAW is lighter and more powerful for easiest handling and fastest sawing. That's why it's so efficient, so economical for both large and small crews. 8 POWERFUL MODELS for use with portable generator or from regular light socket. Also big, fast-cutting PNEUMATIC SKILSAW! Ask for a demonstration.

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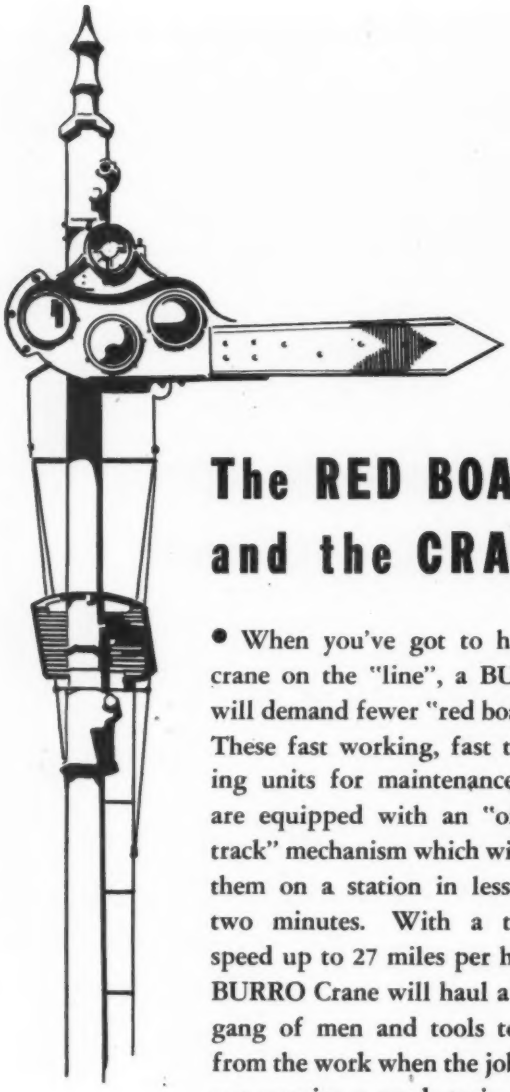
5053 Elston Avenue, Chicago, Illinois
New York • Boston • Buffalo • Philadelphia
Cleveland • Detroit • Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans • Dallas • Los Angeles • Oakland
Seattle • Toronto, Canada

SKILSAW PORTABLE ELECTRIC TOOLS
★ FOR THE DEFENSE OF AMERICA ★

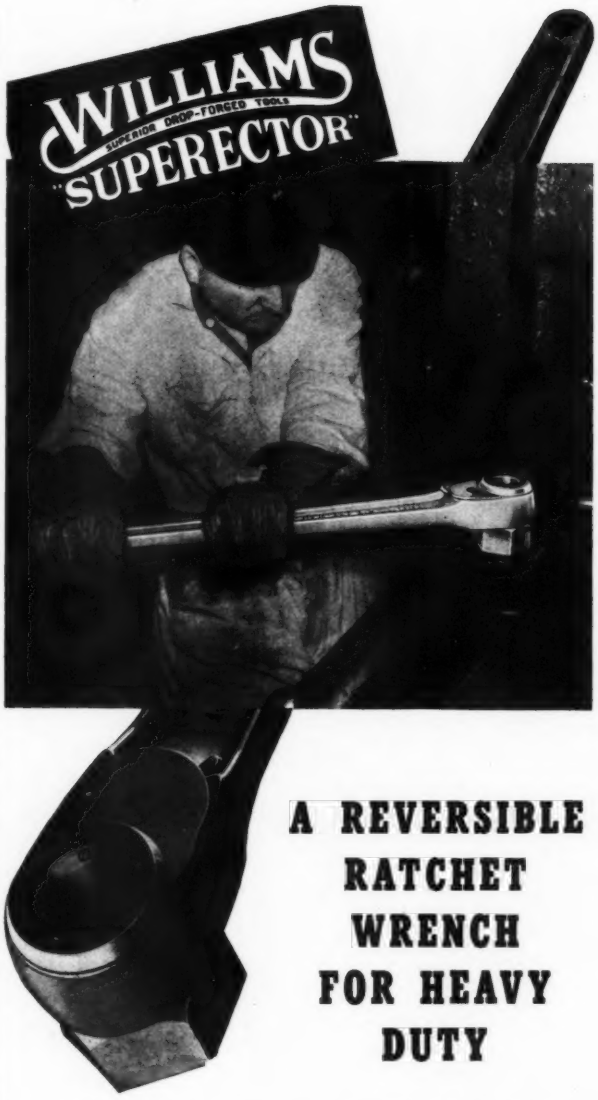


The RED BOARD and the CRANE

• When you've got to have a crane on the "line", a BURRO will demand fewer "red boards". These fast working, fast traveling units for maintenance jobs are equipped with an "off the track" mechanism which will put them on a station in less than two minutes. With a travel-speed up to 27 miles per hour a BURRO Crane will haul a large gang of men and tools to and from the work when the job does not require a work train to be made up. With axle journals spring mounted BURROS follow the rail and are safe at all speeds. With these features and many more representing remarkable economy and efficiency in operation, consider the BURRO and fewer "red boards" with the next crane requisition.

BURRO CRANES

CULLEN-FRIESTEDT CO.
1301 So. Kilbourn Ave., Chicago, Ill.



A REVERSIBLE RATCHET WRENCH FOR HEAVY DUTY

Williams' "Superector" provides faster action, safer operation and greater durability under all kinds of severe service. Its quadruple pawls of hardened tool steel mean that two pawls constantly engage two teeth for both "on" and "off" rotation of nuts. Its drop-forged handle utilizes the extra strength afforded by these pawls.

Williams' "Superector" wrenches are made in five sizes, 24" to 53", for both hex and square sockets, 1" to 4⅝". Sockets have hole extending clear through so that nuts may be drawn down all the way on any length bolt. Sold by industrial distributors everywhere.

"KEEP 'EM FLYING!"

J. H. WILLIAMS & CO., 225 Lafayette St., NEW YORK

ELECTRIC TOOLS ARE HARD TO REPLACE

Reduce Repair Costs— Get Longer Service by Keeping Them Clean and In Condition

A Portable Electric Saw will cut faster, consume less current and run more smoothly if saw is clean and blades are kept properly sharpened at all times.

Stanley Electric Saws are designed and built to last a long time. They'll do that and more, too, if maintained according to the simple instructions packed with each Saw. Let us send you new instructions if you need them.

As usual, Stanley maintains repair service and keeps available replacement parts to serve you promptly during the emergency. Stanley Electric Tool Div. The Stanley Works, New Britain, Connecticut.

Stanley Portable Electric Saws and Drills are helping American railroads to handle today's tremendous war traffic, the biggest job they ever tackled.

KEEP 'EM ON THE JOB WITH PROPER CARE

STANLEY
Electric Tools

As In '17——

IT'S LAYNE WATER SYSTEMS FOR THE ARMY, NAVY AND WAR NEEDS

Built under extreme emergency and with amazing speed, thousands of Layne Wells and Pumps are providing billions of gallons of water for war needs—Army Camps, Flying Fields, Naval Stations, Ordnance Works, Chemical Plants, Munition Plants and numerous fortified outposts. Though built with utmost speed, those Layne Water Systems have the strength and ruggedness which will last for years and years.

Layne Well Water Systems, regardless of when, where or how speedily built, are the finest that can be constructed. They will faithfully fulfill their mission until victory comes, whether this year, next year or years from now.

Those men of the Army, Navy and Marine Corps who some day will return to civilian life may well remember that it was Layne who built the well water systems which helped to win the war.

In the meantime, essential civilian water supply service continues. The Layne organization is fulfilling its pledge of "Keep Them Flowing!"

LAYNE & BOWLER, INC.
Memphis, Tenn.

LAYNE
PUMPS & WELL WATER SYSTEMS

Affiliated Companies

Layne-Arkansas Company	Stuttgart, Ark.
Layne-Atlantic Company	Norfolk, Va.
Layne-Bowler New England Corp.	Boston, Mass.
Layne-Central Company	Memphis, Tenn.
Layne-Northern Company	Mishawaka, Ind.
Layne-Louisiana Company	Lake Charles, La.
Layne-New York Company	New York City.
Layne-Northwest Company	Milwaukee, Wis.
Layne-Ohio Company	Columbus, Ohio.
Layne-Texas Company	Houston, Texas
Layne-Western Company	Kansas City, Mo.
Layne-Western Company of Minnesota	Minneapolis, Minn.
International Water Supply, Ltd.	London, Ontario, Can.

WORLD'S LARGEST WATER [illegible]

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Use this section when seeking a new man, a new position, or when buying or selling secondhand equipment.

CLASSIFIED ADVERTISEMENTS, $10.00 an inch, one inch deep by three inches wide, an insertion.

EMPLOYMENT ADVERTISEMENTS, 10 cents a word a month, including address, minimum charge $2.00.

Remittance must accompany each order.

Railway Engineering and Maintenance
Classified Advertising Department
105 West Adams St., Chicago

POSITION WANTED

Track foreman with large experienced crew looking for work anywhere.

Write F. M., 646 Hegney Place, Bronx, New York.

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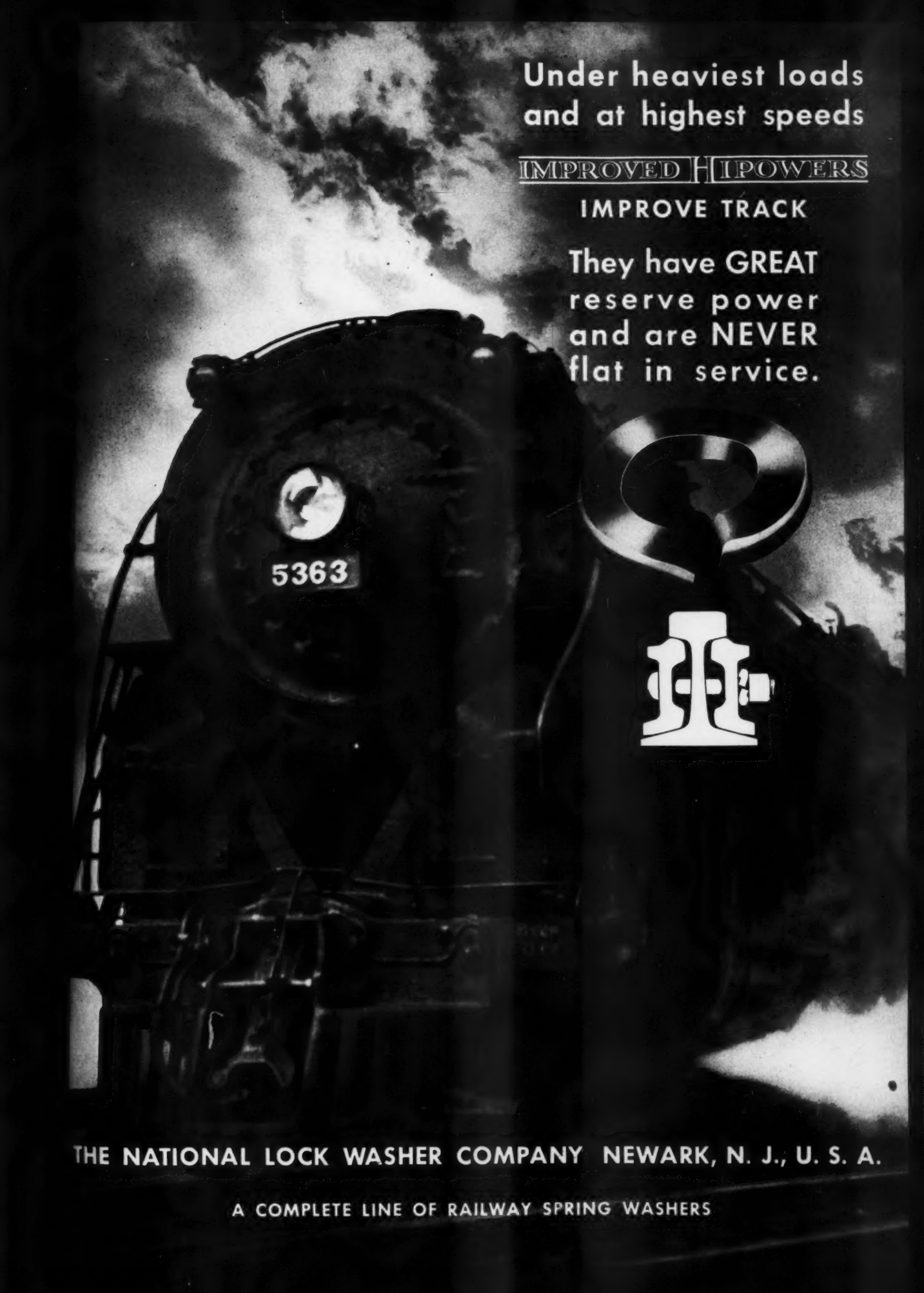
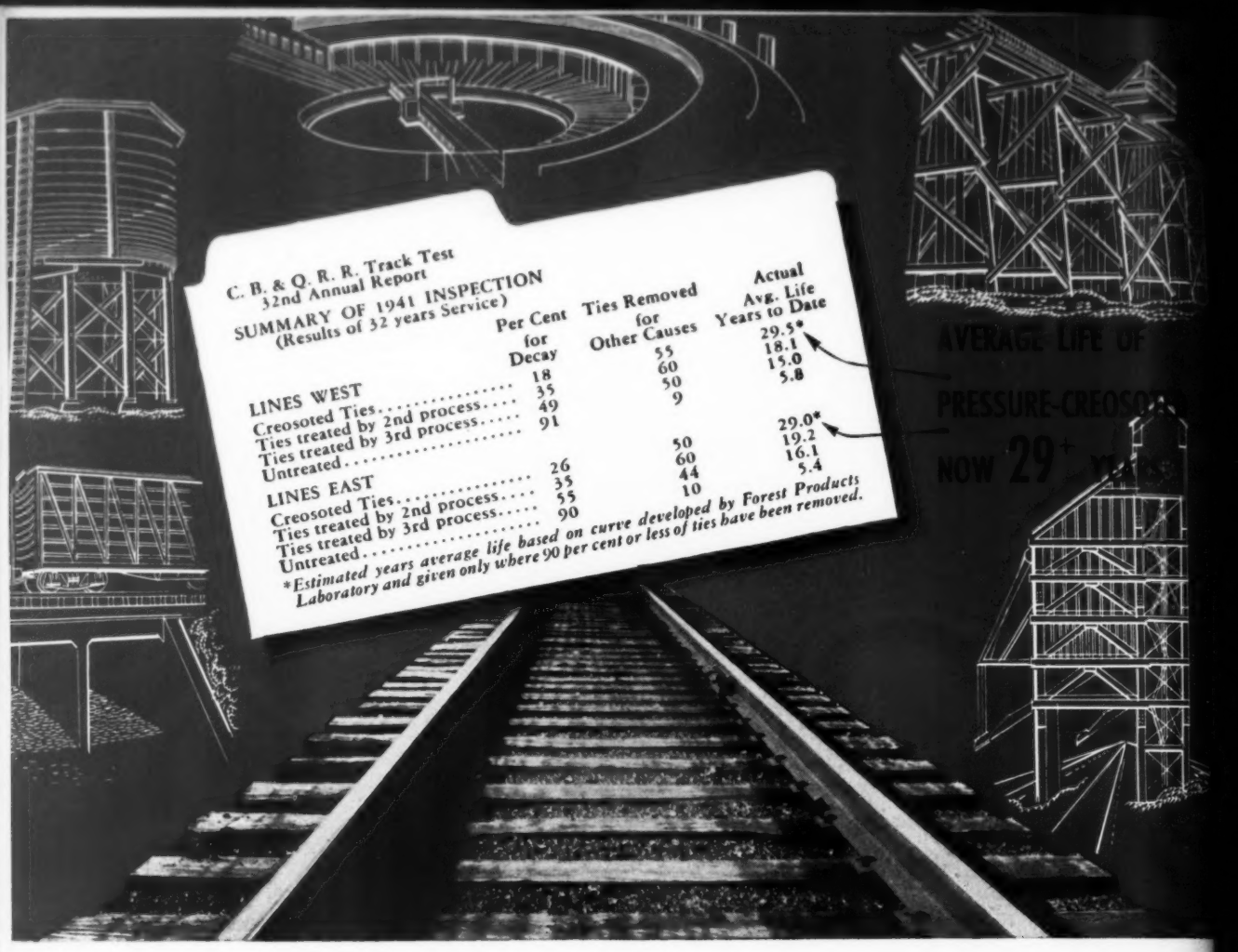

Under heaviest loads
and at highest speeds
IMPROVED HIPOWERS
IMPROVE TRACK
They have GREAT
reserve power
and are NEVER
flat in service.
5363
THE NATIONAL LOCK WASHER COMPANY NEWARK, N. J., U. S. A.
A COMPLETE LINE OF RAILWAY SPRING WASHERS



Proof of **economy** like this is leading many railroads to **other** savings

The 32nd annual report of the famous C. B. & Q. crosstie investigation shows the average life of pressure-creosoted ties up from 28+ years in '40 to 29+ in '41. The actual life of untreated ties remains at an average of 5.6 years.

As little as 20 years ago, only one tie in five was pressure-treated. Now four out of five have this dependable protection. The savings to the railroads of America run up to astronomical figures.

With such proof of economy before them, many engineers are extending these savings to other applications. At the same time they are avoiding many difficulties and delays caused by shortages of vital war materials. A superintendent of water service states that the present cost of a pressure-treated wood tank is less than half that of other permanent materials. Pressure-creosoted decks and stringers used by one railroad in building 200 stock cars in 1925 are still serving, while untreated roofing, slats and posts have been replaced as many as four times. In bridge construction, timber trestles can often be *perpetuated* for a fraction of the interest charges alone on monolithic structures. Over 2,000,000 carloads of pressure-treated timber have been used in the past 10 years.

There are probably a lot of places where pressure-treated wood could save for you . . . and permit needed construction to proceed without draining the limited supply of strategic materials. If you will outline your problem, we will be glad to give you full details of a recommended solution.

WOOD PRESERVING DIVISION
KOPPERS COMPANY
PITTSBURGH • PENNSYLVANIA

use K O P P E R S products